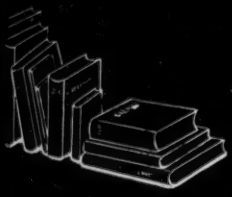
ABSTRACTS OF NORTH AMERICAN GEOLOGY



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JULY 1969

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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July 1969

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1969

UNITED STATES DEPARTMENT OF THE INTERIOR

WALTER J. HICKEL, *Secretary*

GEOLOGICAL SURVEY

William T. Pecora, *Director*

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402. Price 75 cents (single copy). Subscription price: $9.00 a year (12 monthly issues); $2.25 additional for foreign mailing. Use of funds for printing this publication approved by the Director of the Bureau of the Budget (October 10, 1968). (exp. 12/71)

ABSTRACTS OF NORTH AMERICAN GEOLOGY

INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals, but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with small circulation (such as dissertations, open-file reports or memorandums) or of other papers presented orally at meetings.

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ABSTRACTS

Aadland, Rolf. *See* Picard, M. Dane. 00454

Adams, John A. S. *See* Best, Myron G. 06576

Addicott, W. O. *See* Repenning, C. A. 00600

06763 **Agarwal, R. K.** Photoelastic analysis of a composite model: Soc. Mining Engineers Trans., v. 241, no. 4, p. 495–501, illus., table, 1968.

A new technique developed to analyze two-dimensional nonhomogeneous models is described. A simple three-layered medium with a circular hole centrally located in the intermediate layer is considered. The layered sheet is loaded uniaxially perpendicular to the stratification. The Young's modulus of the intermediate is lower than that of the outer layers. The stress distribution around the circular hole in a stratified medium is significantly different when compared to the case of a continuous homogeneous medium. The distribution depends upon the ratio of the height of the intermediate layer and the hole diameter. A comparison of stress distribution and procedures for preparation and testing of the model are given. The potential of the technique is outlined [citing as examples excavations in coal, bedded or vein-type, metallic mineral deposits, and problems involving floor heaves].—*from* Author's abstract

00501 **Agasie, J. M.** Late Cretaceous palynomorphs from northeastern Arizona: Micropaleontology, v. 15, no. 1, p. 13–30, illus., 1969.

The coal-bearing Dakota Sandstone at Coal Canyon, Arizona, in the western portion of the Black Mesa basin, yielded abundant, diverse, and generally well-preserved spores, pollen, and microplankton, including ten new species and two new genera. The palynomorph assemblage is characterized by high frequencies of fern spores, especially striate schizaeaceous spores, and simple tricolpate and tricolporate angiosperm pollen. Gymnosperm pollen grains are comparatively uncommon. On palynologic evidence, the age of the Dakota Sandstone within the study area is interpreted as early Late Cretaceous (Cenomanian).—Author's abstract

Ahrens, Thomas J. *See* Horz, F. 00572

06777 **Aitcin, P. C.; Garnier, G.; Carles-Gibergues, A.** Powder density measurement by hydrostatic weighing: Am. Mineralogist, v. 53, nos. 7–8, p. 1413–1417, illus., table, 1968.

The experimental apparatus and procedure for the accurate determination of the density of powders by hydrostatic weighing are shown schematically and described in detail. This method involves simple and rapid manipulations that reduce human errors considerably in contrast to the pycnometric method.—MEM

06666 **Albright, M. B., Jr.** Subsidence and recent development operations in Wilmington oil field, California: Interstate Oil Compact Comm. Comm. Bull., v. 10, no. 2, p. 3–14, illus., 1968.

Geology and producing zones are reviewed briefly for this oil field near the southwest edge of the Los Angeles sedimentary basin, within the city limits of Long Beach

and Los Angeles. The field is on an anticlinal trend of 20 miles along the coast, over half in tidelands beyond mean high tide. Long the leading oil producer in California, and currently in the United States, it also leads the world in the amount of subsidence it has undergone (over 29 feet at center). It is an example of land subsidence due to withdrawal of subsurface fluids in a small area; water injection to prevent further subsidence exceeds a million bbl per day; the largest such areas known in the world are in California's San Joaquin Valley, where three cover 1400, 800 and 300 sq mi respectively—the result of 50 years of pumping of ground water for irrigation.—GDC

00562 **Alexander, E. G., Jr.; Manuel, O. K.** Xenon in chondrules and matrix material of chondrites: Geochim. et Cosmochim. Acta, v. 33, no. 2, p. 298–301, illus., table, 1969.

Analyses of Xe in two olivine-hypersthene chondrites show that radiogenic Xe-129 resides in both the chondrules and in the matrix material. Radiogenic Xe-129 is more prominent in the chondrules, but the nonradiogenic Xe is more abundant in the matrix material.—Authors' abstract

06382 **Alexander, Robert H.; Bowden, Leonard W.; Marble, Duane F.; Moore, Eric G.** Remote sensing of urban environments, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 889–911, illus., table, 1968.

Major tasks for future applications of urban remote sensing systems include the delimitation of urbanism and monitoring of its growth and decline, the determination of urban land use and internal structure, and the study of urban dynamics, including rapidly changing elements within the city and forces of the physical environment acting upon it. Recent advances in the application of photographic, thermal infrared, radar, and microwave sensors indicate that each can be used as sources of valuable data about urban environments when coupled with an appropriate information system.—GWL

Alexander, S. S. *See* Spence, W. J. 06630

06606 **Ali, Syed A.; Weiss, Malcolm P.** Transmitted infrared photography—Cincinnatian limestones: Jour. Sed. Petrology, v. 38, no. 4, p. 1350–1354, illus., 1968.

Smoothed slabs of limestone, observed and recorded by different methods, reveal sedimentary structures with different degrees of success. Sedimentary structures only dimly visible in ordinary light are made conspicuous by transmitted infrared. Fluorescent dyes penetrate defects in the rocks and reveal little of primary structures. Carbonates respond so uniformly to X-rays that structures are not revealed. Transmitted infrared is thus preferred for carbonates.—Authors' abstract

06352 **Allegre, C. L.** Th-230 dating of volcanic rocks—A comment [on paper by A. Taddeucci, W. S. Broecker, D. L. Thurber, 1968]: Earth and Planetary Sci. Letters, v. 5, no. 3, p. 209–210, illus., 1968.

A plot of results from the Th-230 disequilibrium equation on a (Th-230/Th-232), (U-238/Th-232) diagram shows that upon crystallization different minerals fall along a horizontal line and after a time t, different points define a linear array of given slope and intercept. On a plot of the results from California on Mono and Inyo Craters volcanics given by Taddeucci et al (ibid., v. 3, no. 4, p. 338–342, 1967 [1968]), quartz-olivine and hornblende fall on a single line; the slope indicates an age of 25,000 yr and the intercept is Th-230/Th-232 = 1.008. The glass point falls below this line. A two stage mechanism is suggested for this volcanism: crystallization of minerals at depth, the mineral isochron giving the age; and eruption with partial melting of minerals, the joint glass-hornblende line giving the approximate age.—VSN

06610 **Allen, J. R. L.** The extent of erosion beneath sandstones in turbidites as revealed by scour markings: Jour. Sed. Petrology, v. 38, no. 4, p. 1379–1381, illus., 1968.

Flute marks and transverse scour marks grow as the result of a larger rate of erosion within the marks than on the surrounding bed. It is shown, by introducing the ratio of erosion rates obtained from experiments, that the minimum thickness of mud removed prior to the deposition of a turbidite sandstone is of the order of magnituje of the amplitude of the scour markings on the base of the bed.—Author's abstract

Al-Rawi, Yehya. *See* Gilbert, C. M. 06355

06649 **Alsop, L. E.** Solution of elastic wave equations by finite difference methods [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 8, 1968.

00504 **Althaus, Egon; Johannes, Wilhelm.** Experimental metamorphism of NaCl bearing aqueous solutions by reactions with silicates: Am. Jour. Sci., v. 267, no. 1, p. 87–98, illus., tables, 1969.

The starting materials, illite, glauconite, montmorillonite, and muscovite, were allowed to react with salt–solutions at 1 kb and 350°, 450°, and 550°C, respectively. Na^+ was fixed in Na-bearing aluminosilicates and K^+, Fe^{3+}, Ca^{2+}, and Mg^{2+} entered the fluid phase. The fluid phase became acid, and the amount of NaCl consumed by the reactions increased with increasing temperatures as well as with increasing ionic strength. The K^+/Na^+ ratio of the fluid phase increased with increasing temperature at fixed ionic strength and decreased in isothermal runs with increasing ionic strength. The Fe^{2+}/Na^+ ratio increased both with increasing temperature and salt concentration. At higher temperatures and ionic strengths, Fe^{2+} became the most concentrated cation in the solution next to Na^+.—*from* Authors' abstract

Anders, Edward. *See* Heymann, Dieter. 06677

06500 **Anderson, C. A.** Metamorphosed Precambrian silicic volcanic rocks in central Arizona, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 9–45, illus., tables, 1968.

Silicic volcanic rocks—dacite, rhyolite, and quartz porphyry—constitute about 35 percent of the Yavapai Supergroup, a Precambrian sequence in central Arizona. In addition, the series has 30 percent pillow and amygdaloidal basalt, 5 percent andesitic rocks, and mixed andesitic and silicic-bedded tuffaceous rock. The Supergroup is divided into Ash Creek and Alder Groups, each with about 20,000 feet of lavas and pyroclastic rocks. Pillow basalts, coarsely graded volcanic breccias, and poorly sorted tuffaceous-bedded rocks suggest marine accumulation in an eugeosyncline. The Supergroup is metamorphosed to the greenschist facies. Twenty-five chemical analyses of metamorphosed, silicic volcanic rocks reveal varying ratios of Na and K. The H_2O content, between 5 and 6 percent by volume, may be from interstitial marine water.—*from* Author's abstract

Anderson, Charles A. *See* Coats, Robert R. 06498

06647 **Anderson, Don L.** Shock waves, free oscillations, and the earth's interior [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 5–6, 1968.

00419 **Anderson, Jay Earl, Jr.; Bickford, M. E.; Anderson, R. E.; Odom, A. L.; Berry, A. W.** Precambrian volcanic terrane of the St. Francois Mountains, Missouri [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 1, 1969.

Anderson, R. E. *See* Anderson, Jay Earl, Jr. 00419

06706 **Andrews-Jones, D. A.** The application of geochemical techniques to mineral exploration: Colorado School Mines Mineral Industries Bull., v. 11, no. 6, 31 p., illus., tables, 1968.

The history of geochemical exploration is reviewed, and general principles are stated. The geochemical environment, mobility in both primary and secondary environment, element associations, dispersion, and background and anomalies of geochemical distribution are covered. Factors affecting some specific sampling media are given

for both soils and biological material. About a third of the report is devoted directly to the application to mineral exploration, subjects discussed being: choice of exploration methods, organization of a geochemical exploration program, an exploration sequence, and sampling and analytic techniques. Short sections on statistical aids and future trends conclude the paper. An appendix contains a glossary of technical terms.—ESL

Angino, Ernest E. *See* Goebel, Edwin D. 00394

00420 **Angino, Ernest E.; Dingman, Robert J.** Chemical composition of selected Kansas brines as an aid to interpreting change in water chemistry with depth [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 1–2, 1969.

Angino, Ernest E. *See* Galle, O. Karmie. 06369

00429 **Antoine, John W.** Role of salt tectonics in structural history of western Gulf of Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 206, 1969.

Aoki, Ken-ichiro. *See* Kushiro, Ikuo. 06753

06788 **Araki, T.; Finney, J. J.; Zoltai, T.** The crystal structure of augelite: Am. Mineralogist, v. 53, nos. 7–8, p. 1096–1103, illus., tables, 1968.

The structure of augelite, $Al_2(PO_4)(OH)_3$, was determined on a crystal from Mono County, California with unit cell $a=13.124$, $b=7.988$, $c=5.066$ A, $\beta=112.25°$, and space group C2/m. In the augelite structure two Al (1) and two Al (2) polyhedra are linked together by sharing OH–OH edges and are concentrated in layers parallel with the 00*l* plane and are separated by $d(001)$. These groups of aluminum polyhedra are connected with each other by phosphate tetrahedra sharing corner oxygen atoms, thus linking the polyhedra into a continuous network. Aluminum has two different coordinations in this structure; one is coordinated to four OH and two O; the other, to three OH and two O.—MEM

Armstrong, R. L. *See* Dasch, E. J. 00404

00607 **Armstrong, Richard Lee.** Control of sea level relative to the continents: Nature, v. 221, no. 5185, p. 1032–1043, 1969.

The major controls on sea level on an Earth with constant ocean and crust volumes are polar and glacial ice, mountain building–erosion, and the ocean rises. Observed sea level will represent an integration of the effects of these partially independent controls, but on both an immediate and long-term basis the rises are the most important. Major transgressions and regressions on a time scale of 10^7–10^8 yr will be related to geographic redistribution of the rises. On a larger time scale the gradual retreat of epeiric seas from cratons may be a result of reduced volume of rises as a consequence of diminished heat production within the Earth. The idea that longer cycles in Earth history are related to overturning of the upper mantle on a time scale of 10^9 yr is very speculative. An expanding Earth is not necessary, but a small amount of expansion can neither be proved nor disproved by available data.—DBV

00517 **Arno, Stephen F.** Glaciers in the American West: Nat. History, v. 78, no. 2, p. 85–89, illus., 1969.

There are about 1,000 active glaciers in the mountains of seven western states; the area of these glaciers covers about 200 sq mi. Glacier locations in each of these states are discussed.—KAF

06641 **Arnold, R. W.** Application of clay crystallite-size in soil genesis studies: Iowa Acad. Sci. Proc. 1967, v. 74, p. 122–129, illus., table, 1968.

Many soils have clay-enriched horizons that are thought to result from pedogenic processes. Various hypotheses are proposed for expected clay size-distributions in soil profiles. The average size of clay crystallites determined by the amount of

broadening of X-ray diffraction peaks ranged from 160 to > 2000A°, but the lack of trends in four loess-derived soils did not permit the hypotheses to be evaluated. An unexpected relationship in a well expressed illuvial horizon was noted: As the percent of accumulated clay increased to the observed maximum the average crystallite size also increased rather than decreased as proposed. This suggests that small-sized illuvial clay particles undergo reorganization to form larger stable crystallites. Knowledge of clay crystallite size is expected to supplement other data in interpreting soil genesis.—Author's abstract

Ashton, William H. *See* Ross, Malcolm. 06568

00555 **Asseez, L. O.** Color standardization in shale analysis: Geol. Soc. America Bull., v. 80, no. 4, p. 721–723, illus., 1969.

Combined with thickness studies, a careful examination of the color variations not only brings out the intraformational and interformational relationships more clearly, but also reduces the ambiguity of most color descriptions. When such standards are related to the Rock Color Chart, descriptions will be meaningful to people who have only the chart.—HCR

Auld, Judith A. *See* McCammon, Helen M. 00620

Austin, George S. *See* Parham, Walter E. 00393

00625 **Ayrton, William G.; Berry, William B. N.; Boucot, Arthur J.; Lajoie, Jean; Lespérance, Pierre J.; Pavlides, Louis; Skidmore, W. Brian.** Lower Llandovery of the northern Appalachians and adjacent regions: Geol. Soc. America Bull., v. 80, no. 3, p. 459–483, illus., tables, geol. map, 1969.

Rocks of early Llandovery age, as well as rocks classed as early Llandovery from regional relationships appear to be widespread in the northern Appalachians and adjacent regions. The paleogeography consisted, in general, of three source areas alternating from east to west with three belts of clastic sedimentation. The westernmost clastic belt grades westward into carbonate rocks of the platform. The Central Clastic Belt encloses impure carbonates with clastic interbeds. Llandovery age rocks include the Manitoulin Dolomite and Ellis Bay Formation. Coeval rocks occur within the Carys Mills Formation and Matapedia Group, as well as the following clastic formations: Grimsby, Shawangunk, Tuscarora, Massanutten, Clinch, Smyrna Mills, Perham, Cabano, Weir, Beechhill Cove, Ross Brook and White Rock.—*from* Authors' abstract

00580 **Babcock, Randall S.; Misch, Peter.** Presumed anatectic origin of late metamorphic orthogneiss dikes in the Skagit Gneiss, North Cascades, Washington State [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 63, 1969.

06625 **Badal, Julian C.** A study of second order ripples [abs.]: Maritime Sediments, v. 4, no. 2, p. 53, 1968.

00476 **Bailey, D. K.; Macdonald, R.** Alkali-feldspar fractionation trends and the derivation of peralkaline liquids: Am. Jour. Sci., v. 267, no. 2, p. 242–248, illus., 1969.

Plotting a series of compositions in a triangular diagram in terms of molecular alumina, silica, and total alkalis will reveal any consistent trend in silica and total alkali variation such as might be expected by feldspar fractionation. A quadrilateral diagram in which the molecular alumina is plotted against soda/potash ratio can then be employed to show the variation in alkali ratio in whole rocks (and their feldspars) with changes in silica content and peralkalinity. Many of the pantellerites examined in this way appear to be on a quartz-feldspar crystallization path. Moreover, there is no strong indication that they have been simply derived from a trachyte parent by feldspar fractionation.—*from* Authors' abstract

06499 **Bailey, Helen E.** A selected bibliography of Howel Williams, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 3–7, 1968.

This bibliography of 77 entries includes papers published by Howel Williams or by Williams and coauthors in the period 1921 through 1965.—VSN

Bailey, Roy A. *See* Smith, Robert L. 06497

Bailey, Roy A. *See* Doell, Richard R. 06579

00592 **Baldwin, Brewster; Dott, Robert H., Jr.** Council on Education in the Geological Sciences and curriculum guidelines [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 1, Northeastern Sec., p. 2–3, 1969.

00422 **Baldwin, Ewart M.** Geologic map of the Myrtle Point area, Coos County, Oregon: U.S. Geol. Survey Mineral Inv. Field Studies Map MF–302, scale 1:48,000, sections, text, 1969.

The Myrtle Point area lies in the southern end of the Coos Bay coal field where nearly all mined coal was from the upper member of the Coaledo Formation; in the mapped area, most of this member has been eroded and only a few hundred feet of the basal strata remain. Wells drilled in the Coaledo disclosed gas, but the short-time yield did not encourage further exploration. Basalt is quarried for road metal in the northeastern corner of the area.—MCM

00606 **Ball, Ian R.; Fernando, C. H.** Freshwater triclads (Platyhelminthes turbellaria) and continental drift: Nature, v. 221, no. 5186, p. 1143–1144, illus., 1969.

There is no fossil record of the freshwater Tricladida, but owing to their low vagility their present day taxonomy and distribution may be a good guide to their past history. It is shown that the distributional patterns in the main species groups of the genera *Dugesia* and *Cura* are best explained by continental drift rather than by long-term dispersal. This reinforces conclusions drawn from similar data on such diverse groups as the Ostracoda, Plectoptera, and Chironomidae.—DBV

00590 **Bamber, E. W.; Barss, M. S.** Stratigraphy and palynology of a Permian section, Tatonduk River, Yukon Territory: Canada Geol. Survey Paper 68–18, 39 p., illus., table, 1969.

The following stratigraphic units are described: (1) rock unit A, 859 feet thick, pyritic shale and siltstone with thin-bedded chert at base; (2) rock unit B, 1,279 feet thick, interbedded, argillaceous, spicular limestone and calcareous, pyritic shale; (3) middle recessive unit (Nelson, 1961), 1,648 feet thick, interbedded siltstone, shale, and limestone with sandstone and conglomerate; (4) Tahkandit Formation, 1,088 feet thick, spicular chert with limestone, dolomite, and siltstone. The lower three units contain a variety of Lower Permian monosaccate, bisaccate, and striate sporomorphs, associated with a marine fauna including Wolfcampian fusulinid in upper part of the third unit. Occurrence of reworked Devonian(?) and Lower Carboniferous sporomorphs with the Permian assemblage reflects Early Permian erosion, producing a widespread sub-Permian unconformity.—*from* Authors' abstract

06634 **Barazangi, Muawia; Dorman, James.** World seismicity maps compiled from ESSA, Coast and Geodetic Survey, epicenter data, 1961–1967 [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 15–16, 1968.

00496 **Barfield, Billy J.; Smerdon, Ernest T.; Hiler, Edward A.** Prediction of sediment profiles in open channel flow by turbulent diffusion theory: Water Resources Research, v. 5, no. 1, p. 291–299, illus., 1969.

Using turbulent diffusion theory, a nonsteady-state model of sediment transportation is developed in the form of a partial differential equation relating the change of sediment concentration with time to the change of concentration in space. The required input to the model is the root-mean-square fluid velocity, the time scale of turbulence, and the mean particle fall velocity. Preliminary experimental investigations are reported using turbulence measurements made over a smooth channel. When smooth channel turbulent intensities were used, predicted sediment concentrations were low when compared with actual measurements. When

turbulent intensities were used from an artificially roughened channel, the predicted concentrations were of the same order as the measured concentrations. Since data were not available for turbulent intensities in alluvial channels, no conclusion could be made about the validity of the model.—Authors' abstract

Barlow, James A., Jr. *See* Haun, John D. 00436

06626 **Barr, Jim L.** Current ripple structures in an intertidal zone—Minas Basin, Bay of Fundy [abs.]' Maritime Sediments, v. 4, no. 2, p. 53, 1968.

06400 **Barringer, A. R.; McNeill, J. D.** Radiophase—A new system of conductivity mapping, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 157–167, illus., tables, 1968.

Signals from VLF radio stations are used to detect the presence of dipping conductive sheets in the ground and to estimate the surface impedance of a homogeneous or horizontally stratified earth. The components of the VLF horizontal magnetic and electric fields which are in phase quadrature with the vertical electric field are measured. Potential applications are airborne mapping of mineral occurrences, of water conductivity to determine the extent of pollution and estuarine salinity, and of ground conductivity to locate faults, shear zones, permafrost, and aquifers.—GWL

Barss, M. S. *See* Bamber, E. W. 00590

Bauer, William J. *See* Koelzer, Victor A. 06667

Bauleke, Maynard P. *See* Hardy, Ronald G. 06370

06371 **Bauleke, Maynard P.; Edmonds, Clarence S.** Thermal expansion of siliceous Kansas clays (Dakota Formation), *in* Short papers on research in 1967: Kansas Geol. Survey Bull. 191, pt. 1, p. 13–15, illus., tables, 1968.

Thermal expansion data are presented for eight siliceous clays from the Dakota Formation in Kansas. In clays that contain high percentages of free quartz, the negative thermal expansion behavior of the beta–quartz exerts a controlling influence on the thermal expansion of the fired clay.—Authors' abstract

Bauleke, Maynard P. *See* Huh, John M. 06372

06447 **Baur, W. H.; Rama Rao, B.** The crystal structure and chemical composition of vauxite: Am. Mineralogist, v. 53, nos. 5–6, p. 1025–1028, illus., tables, 1968.

Crystal structure analysis of vauxite proves its composition to be $FeAl_2(PO_4)_2(OH)_2 \cdot 6H_2O$, $Z = 2$. The structure is characterized by infinite chains of FeO_6 and AlO_6 octahedral which extend parallel to [001]. Tetrahedral chains of PO_4 tetrahedra link to the octahedral chains.—MR

06486 **Bayley, Richard W.** Geologic map of the Bradley Peak quadrangle, Carbon County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ–773, scale 1:24,000, sections, 1968.

Beamish, F. E. *See* Chung, K. S. 06743

06627 **Bedi, V. K.** Cross–stratification at Pinnacle–Long Island Flats, Five Islands, Minas Basin, Bay of Fundy, Nova Scotia [abs.]: Maritime Sediments, v. 4, no. 2, p. 53, 1968.

00617 **Bennett, J. M.; Smith, J. V.** Positions of cations and molecules in zeolites with the faujasite–type framework—[Pt.] 4, Dehydrated La–exchanged faujasite at 420°C: Materials Research Bull., v. 4, no. 1, p. 7–13, tables, 1969.

The crystal structure of dehydrated La–exchanged faujasite at 420°C is almost identical in all respects with that at room temperature, thus indicating that the cation positions are essentially independent of temperature so long as the chemical

composition is held constant. The La atom is again displaced along the triad axis suggesting preferred bonding to three O(3). The O(2) atoms are strongly displaced along the direction of the La atom. Perhaps these properties may produce a domain structure which might be ferro-electric.—Authors' abstract

Bennett, Lee C., Jr. *See* Grim, Muriel S. 00543

00582 **Bennett, Lee C., Jr.** Structural studies of the continental shelf off Washington [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 63, 1969.

Bennett, Robert R. *See* Cooper, Hilton H., Jr. 06580

06786 **Berg, G. W.** Secondary alteration in eclogites from kimberlite pipes: Am. Mineralogist, v. 53, nos. 7–8, p. 1336–1346, illus., tables, 1968.

An analcime-type zeolite has been found in eclogite xenoliths from a kimberlite pipe. Analytical data obtained for the primary pyroxene (omphacite) and secondary minerals (mica, analcime, clay) indicate that the xenoliths have been contaminated by K,Rb and Cs, which are important for the study of the origin of eclogites. Metasomatic alteration of an eclogite during the intrusion of the kimberlite may be followed by further contamination of the eclogite by the migration of elements during the weathering of the kimberlite. For many elements abundance data must be determined on separated primary eclogite minerals and data obtained on whole-rocks should be treated with some circumspection.—*from* Author's abstract

00461 **Berg, Robert R.; Davies, David K.** Petrography and permeability of Lower Cretaceous Muddy Sandstone, Bell Creek area, Montana [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 218–219, 1969.

Bergenback, R. E. *See* Williams, E. G. 06595

Bergquist, Harlan R. *See* Ross, Clarence S. 06597

00502 **Berner, Robert A.** Migration of iron and sulfur within anaerobic sediments during early diagenesis: Am. Jour. Sci., v. 267, no. 1, p. 19–42, illus., 1969.

Three diagenetic models based on layered situations are presented to illustrate factors affecting migration of iron and sulfur in recent anaerobic sediments. Two important factors are sharp variation with depth of organic matter content, which is assumed to be the same in each model, and the original concentration of reactive (toward H_2S) ferruginous material, which is varied between models. Juxtaposed artificial sediments of greatly differing organic matter content undergo quantitative changes in the laboratory predicted by the three models. The experiments also demonstrate quantitatively the general validity of the low iron-content model. The same reasoning applied to layer models can be recast in a three-dimensional context to describe changes in organic-poor sediment surrounding an organic-rich body.—*from* Author's abstract

00565 **Berner, Robert A.** Goethite stability and the origin of red beds: Geochim. et Cosmochim. Acta, v. 33, no. 2, p. 267–273, illus., table, 1969.

The differential solubility of hematite and goethite in 0.1 M HCl has been determined at 85°C. From this, calculations show that finely divided limonitic goethite is thermodynamically unstable relative to hematite plus water under practically all geological conditions. This indicates that many ancient red sediments could have been originally yellow and that the red color could have developed diagenetically even during shallow burial at low temperatures. The data also indicate that limonitic goethite should be thermodynamically unstable on the surface of Mars.—Author's abstract

Berry, A. W. *See* Anderson, Jay Earl, Jr. 00419

Berry, William B. N. *See* Ayrton, William G. 00625

06576 **Best, Myron G.; Henage, Lyle F.; Adams, John A. S.** Mica peridotite, wyomingite, and associated potassic igneous rocks in northeastern Utah: Am. Mineralogist, v. 53, nos. 5–6, p. 1041–1048, illus., tables, 1968.

Occurrences of highly potassic, silica-poor igneous rocks from northeastern Utah are described; five rock analyses and a chemical analysis with X-ray diffraction data of a ferriferous sanidine are presented. K–Ar age determinations indicate two episodes of lamproitic activity ranging from 33 to 37 m.y. and 25.5 to 37 m.y.—BAM

06376 **Bhatnagar, Vijay Mohan.** Infrared spectra of hydroxyapatite and fluorapatite, *in* Colloque international sur les phosphates minéraux solides, Toulouse, 1967—V. 1, Structure et propriétés des phosphates: Paris, Soc. Chim. France, p. 125–127, tables, 1968.

The infrared spectra of hydroxyapatite and fluorapatite over the range 4,000–200 cm^{-1}, are reported. The molecular symmetry T_d of the undistorted tetrahedral phosphate group is assumed to be reduced and have the same symmetry as that of the site in the crystal. Modes ν_1 and ν_2 which in the free or undistorted ion involve no change of dipole moment become infrared active due to the loss of symmetry. The normal modes ν_2, ν_3, and ν_4 lose their degenerate character. Fluorapatite does not show the presence of 635 and 3 578 cm^{-1} bands due to OH^- groups showing that hydroxyl groups of hydroxyapatite have been replaced by F^- ions. The nature and extent of changes in vibration frequencies of hydroxyapatite with the substitution of F^- ion for OH^- are discussed.—*from* Author's abstract

Bickford, M. E. *See* Anderson, Jay Earl, Jr. 00419

00421 **Bickford, M. E.; Mose, D. G.; Wetherill, G. W.** Age of the Rose Dome Granite, Woodson County, Kansas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 2, 1969.

Biggs, Charles A. *See* McGregor, Alexander A. 00456

00505 **Bingham, Roy H.** Springs in northeastern Oklahoma [abs.]: Oklahoma Geology Notes, v. 29, no. 1, p. 19, 1969.

06715 **Bingler, E. C.; Hillard, P.; Mallon, K. H.** Reconnaissance geologic map and sections of El Rito seven and one half minute quadrangle, New Mexico: New Mexico Bur. Mines and Mineral Resources Geol. Map 20, scale 1:24,000 [1968?].

06716 **Bingler, E. C.; Hillard, P.; Mallon, K. H.** Reconnaissance geologic map and section of Valle Grande Peak seven and one half minute quadrangle, New Mexico: New Mexico Bur. Mines and Mineral Resources Geol. Map 21, scale 1:24,000 [1968?].

00442 **Birdseye, Henry S.** Geothermics in North America—Present and future [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 212, 1969.

06460 **Birle, J. D.; Gibbs, G. V.; Moore, P. B.; Smith, J. V.** Crystal structure of natural olivines: Am. Mineralogist, v. 53, nos. 5–6, p. 807–824, illus., tables, 1968.

Atomic parameters were obtained by 3D least-squares X-ray diffraction analysis of forsterite ($Mg_{0.90}Fe_{0.10}$, plutonic hyalosiderite ($Mg_{0.535}Fe_{0.456}Mn_{0.006}Ca_{0.002}$) hortonolite ($Mg_{0.49}Fe_{0.49}Mn_{0.01}Ca_{0.01}$), and fayalite ($Fe_{0.92}Mg_{0.04}Mn_{0.04}$). The closeness in value of the isotropic temperature factors calculated for the M sites indicates substitutional disorder of the Mg and Fe atoms in all four structures. Polyhedra distortions are closely similar in all four structures showing that they depend on the structure type rather than on the Mg, Fe substitution.—*from* Authors' abstract

06482 **Black, Douglas F. B.** Geologic map of the Ford quadrangle, central Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-764, scale 1:24,000, section, text, 1968.

Several vein deposits of barite, fluorite, calcite, and minor sphalerite have been prospected in the Ford quadrangle, and at least one, the Smitha vein was mined in the early 1900's. Post-mineral strike-slip faulting is strongly indicated in two areas. None of the anticlines is known to have been tested for petroleum. Limestone and dolomite for agricultural lime and crushed aggregate are mined from the Oregon Formation, the lower part of the Tyrone Formation, and the Camp Nelson Limestone.—MCM

06781 **Blackburn, W. H.; Dennen, W. H.** Flattened garnets in strongly foliated gneisses from the Grenville series of the Ganonoque Area, Ontario: Am. Mineralogist, v. 53, nos. 7–8, p. 1386–1393, illus., table, 1968.

In the Grenville gneisses flattened and elongated almandine garnets occur on the surfaces of foliation, whereas the garnets of adjacent quartz-feldspar layers are rounded and of a smaller size. Studies of equilibration domains in these gneisses show that chemical commucication and therefore diffusion is enhanced along foliation surfaces. It is proposed that differential ease of diffusion of material to and from the site of garnet growth has controlled garnet morphology. Further, the inhibition of diffusion across foliation planes has limited chemical communication between garnets of the foliation surfaces and those in the adjacent layers rich in quartz and feldspar. This effect was observed in the form of adjacent layers containing garnets with contrasting compositions.—Authors' abstract

06441 **Blackerby, Bruce A.** Convolute zoning of plagioclase phenocrysts in Miocene volcanics from the Western Santa Monica Mountains, California: Am. Mineralogist, v. 53, nos. 5–6, p. 954–962, illus., tables, 1968.

Plagioclase phenocrysts from a series of andesitic basalt flows, pyroclastics, and epiclastics in the Western Santa Monica Mountains of Los Angeles County, California, characteristically exhibit an unusual textural feature referred to here as "convolute zoning." Phenocrysts exhibiting this texture are embayed, the compositional zoning being thinner and "deflected" inward following the contours of the embayments. A possible explanation of this feature is that the embayments represent response by growing crystals to semiporous obstructions encountered during crystallization. This suggests that similar resorption textures reported for unzoned crystals, which may not have left a clear record of events, may not in all cases represent magmatic corrosion.—Author's abstract

00412 **Blackwell, David D.** Relation of heat flow and basement rocks in the midcontinent [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 2–3, 1969.

00593 **Blackwell, Phillip W.; Morrison, Jack L.; Smith, Wayne E., Jr.** GIPSY computer retrieval of geologic literature: Oklahoma Geology Notes, v. 29, no. 1, p. 6–14, illus., 1969.

The Generalized Information Processing System (GIPSY), a user-orientated data storage and retrieval system developed at the Merrick Computer Center of the University of Oklahoma, is not primarily a literature-searching system but can be useful in that area. It permits the entire content of a document to be available as selection criteria. Magnetic tapes from the Abstracts of North American Geology (USGS) were used in a test; a typical dialog sequence is given. A procedure known as iteration allows the user to ask another question that will cut down the answers to a readable number. An example of the use of the system in an annotated search is given. The system does not require an intermediate programmer between the geologist and his data as exhaustive searches can be done in minutes; it is also useful for browsing. Possibilities of a Geologic Information Center are discussed.—ESL

Bloch, S. *See* Hales, A. L. 00608

00564 **Blount, C. W.; Dickson, F. W.** The solubility of anhydrite ($CaSO_4$) in NaCl-H_2O from 100 to 450°C and 1 to 1000 bars: Geochim. et Cosmochim. Acta, v. 33, no. 2, p. 227–245, illus., tables, 1969.

The solubility of anhydrite was determined at temperatures ranging from 100° to 450°C, pressures from 1 to 1000 bars, and in solutions ranging in NaCl concentration from dilute to 6 moles NaCl per kg of H_2O. The scarcity of anhydrite as a hydrothermal mineral and its abundance as an evaporate mineral is in accord with the tendency for upward migrating solutions to maintain undersaturation with respect to anhydrite. Only after the components of anhydrite reach a surface environment in which evaporation occurs would $CaSO_4$ be deposited in major quantity.—KAF

00624 **Blount, Don N.; Moore, Clyde H., Jr.** Depositional and non-depositional carbonate breccias, Chiantla quadrangle, Guatemala: Geol. Soc. America Bull., v. 80, no. 3, p. 429–441, illus., table, 1969.

Five types of carbonate breccia are recognized in the Chiantla quadrangle of northwestern Guatemala. Depositional breccias are widespread in the Cretaceous Ixcoy limestone and attain thicknesses up to 500 m. Evaporite-solution-collapse breccia in a sequence 250 m thick occurs in the lower Ixcoy and is characterized by dolomite clasts in a matrix of sparry calcite and granulated dolomite. Other breccia types found are tectonic breccia, caliche breccia, and pseudobreccia. Pseudobreccia, formed by selective grain growth, can be distinguished by similarity in lithology between clasts and matrix, presence of irregular clast shapes, and a complete gradation in grain size from micrite in the 'clasts' to sparry calcite in the 'matrix'.—*from* Authors' abstract

06607 **Boggs, Sam, Jr.** Experimental study of rock fragments: Jour. Sed. Petrology, v. 38, no. 4, p. 1326–1339, illus., tables, 1968.

An experimental study was conducted on a suite of igneous, metamorphic, and sedimentary rocks which had been artificially fragmented to five size fractions: granule, very coarse sand, coarse sand, medium sand, and fine sand. These fractions were studied to determine changes in textural properties with progressive size reduction and the feasibility of identifying parent rock textures in fragments ranging from granule to fine sand size. The diagnostic textures of all the rocks studied are preserved to essentially the same degree in granule-sized fragments as in thin sections of parent rocks. Identification is less reliable in smaller sizes and depends upon the mean grain size and sorting of the parent rock.—*from* Author's abstract

06731 **Bollinger, G. A.** The Narrows, Virginia, earthquake of March 8, 1968: Earthquake Notes, v. 39, nos. 3–4, p. 35–47, illus., tables, 1968.

The Narrows, Virginia, earthquake of March 8, 1968 was located at 37.3° N., 80.8° W., with an origin time of 05:38:15.2 GMT. The Eastern Tennessee crustal model of Steinhart and Meyer (1961) was employed for this location, and the resulting traveltime residuals for seven stations showed a standard deviation of 0.4 second. This fit to the observed traveltimes implies that the Eastern Tennessee model may be more appropriate for the region than the standard Jeffreys-Bullen crustal model. Macroseismic data for the earthquake gave a maximum intensity (MM) of IV and a felt area of approximately 3,200 square miles.—Author's abstract

06443 **Bonatti, Enrico; Joensuu, Oiva.** Palygorskite from Atlantic deep sea sediments: Am. Mineralogist, v. 53, nos. 5–6, p. 975–983, illus., tables, 1968.

A deep-sea sediment core collected from the Barracuda Escarpment in the western Atlantic, contains a layer with a large number of nodular aggregates up to a few cm in size. Palygorskite is the main component of the majority of the aggregates. Other minerals present are clinoptilolite, serpentine, smectites, sepiolite, and quartz. In some of the aggregates clinoptilolite rather than palygorskite is the major component. Palygorskite was probably formed by Mg-rich solutions, possibly hydrothermal, acting on sedimentary montmorillonite-group clays.—Authors' abstract

06789 **Bonham-Carter, G. F.; Sutherland, Alex J.** Mathematical model and FORTRAN IV program for computer simulation of deltaic sedimentation: Kansas Geol. Survey Computer Contr. 24, 56 p., illus., tables, 1968.

In DELTASIM, a program for simulating sedimentation at a river-channel mouth, flow into a tideless, currentless marine basin is modeled as a plane jet discharging horizontally at the ocean surface; velocity field is calculated by equations for open-channel and plane-jet flow. Statistically, sediment particles are traced from the mouth as they spread laterally and settle; accumulation rate is calculated for each cell of a horizontal grid. Experiments with a static model illustrate depositional variation with changes in grain size, river depth, and slope in a narrow area; in elevation, foreset slopes are normally less than 1°. With a dynamic model, delta platform can build forward, particle trajectories adjusting automatically to position on the lip. Experiments illustrate formation of bars across river mouth and submerged levees marginal to flow. Graphic displays, CALCOMP plots, are important in the program output.—*from* Authors' abstract

00413 **Boone, Peter A.** Topographic control of sedimentation—An example from the Lower Cretaceous of north-central Texas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 3, 1969.

00574 **Bostrom, R. C.; Vali, V.** Ground deformation in western Washington [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 61, 1969.

00545 **Bottinga, Y.** Calculated fractionation factors for carbon and hydrogen isotope exchange in the system calcite-carbon dioxide-graphite-methane-hydrogen-water vapor: Geochim. et Cosmochim. Acta, v. 33, no. 1, p. 49–64, illus., tables, 1969.

Isotopic fractionation factors have been calculated for deuterium exchange between hydrogen, water vapor and methane, and for C-13 exchange between graphite, calcite, CO_2 and methane. These fractionation factors have been tabulated at various intervals between 0° and 700°C. Some geochemical applications of the calculated data are discussed.—Author's abstract

Bottrill, T. J. *See* Prest, V. K. 00598

Boucot, Arthur J. *See* Ayrton, William G. 00625

Bowden, Leonard W. *See* Alexander, Robert H. 06382

Bowen, V. T. *See* Thompson, Geoffrey. 06600

00459 **Bowman, Joe L.** Oil-impregnated sandstones between Dirty Devil and Colorado and Green Rivers, Garfield and Wayne Counties, Utah [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 218, 1969.

Bozic, John. *See* Holland, William J. 06741

00484 **Brabb, Earl E.; Churkin, Michael, Jr.** Age of Nation River Formation, east-central Alaska (discussion of paper by L. R. Laudon, et al., 1966): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 430–439, illus., 1969.

Brabb and Churkin summarize evidence for the Late Devonian age of the Nation River Formation and present data indicating that an unconformity exists between the top of the Nation River and the base of the overlying conglomerate and sandstone member of the Tahkandit Limestone of Permian age. The Devonian age of the formation and the overlying unconformity do not complicate the stratigraphy and structure of the area as Laudon, et al (ibid., v. 59, no. 9, p. 1868–1889, 1966) thought it would. Rather the opposite is true; the recent discovery of a widespread unconformity at the base of the Permian in adjoining areas indicates that the geologic history in east-central Alaska is now in harmony with adjoining areas.—SEF

00596 **Branson, Carl C.** Historic Wilson Rock—A Keota Sandstone outcrop: Oklahoma Geology Notes, v. 29, no. 1, p. 14–17, illus., 1969.

Wilson Rock, a prominent feature on the Arkansas River in Sequoyah County, Okla., and an outcrop of the Keota Sandstone Member of the McAlester Formation, is flat-lying, light gray, calcareous, and micaceous. The outcrop is flat-topped,

eroded to a bedding plane 12 feet above normal water level; maps show the Rock to be on a sand flat. The sandstone has been quarried to the west. Some historic facts about the Rock are given also.—ESL

Bredehoeft, John D. *See* Cooper, Hilton H., Jr. 06580

06702 **Brewer, Richard.** Two birds new to the Pleistocene of Reddick, Florida: Florida Acad. Sci. Quart. Jour., v. 31, no. 1, p. 79–80, 1968.

Two bird bones represent taxa not previously reported from the Reddick Pleistocene beds. A heron coracoid, Ardeidae gen. and sp. undet., resembles the contemporary *Hydranassa tricolor, Leucophoyx thula*, and *Florida caerulea*, but is somewhat larger; comparative measurements and ratios are given. The fossil is not similar to *Paleophoyx columbiana* reported from the Florida Pleistocene by McCoy (1963). A tarsometatarsus of the Mississippi kite, *Ictinia misisippiensis*, seems to be the first Pleistocene record of this extant species.—VMJ

Brey, Mary E. *See* Friedman, Gerald M. 06599

06710 **Briggs, Peter.** Men in the sea: New York, Simon and Schuster, 128 p., illus., 1968.

The biographies of nine oceanographers: Roger Revelle, Athelstan Spilhaus, George Bond, Anton Bruun, Maurice Ewing, Edwin A. Link, Townsend Cromwell, Columbus O'Donnell Iselin, and Taylor Aldrich Pryor, and one chapter on the little submarine, *Alvin*, comprise the ten chapters of the book.—ESL

Brindley, G. W. *See* Heydemann, Annerose. 06774

06543 **Bromberger, Samuel H.** Basal Maquoketa phosphatic beds [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2084B, 1968.

Brookins, Douglas G. *See* Voss, James D. 00370

00385 **Brookins, Douglas G.** The significance of K–Ar dates on altered kimberlitic phlogopite from Riley County, Kansas: Jour. Geology, v. 77, no. 1, p. 102–107, illus., table, 1969.

Five known kimberlites intrude Lower Permian sedimentary rocks in Riley County, Kans. Structural studies show that these kimberlites were emplaced in Late Cretaceous (post–Dakota Sandstone) time. Four K–Ar age determinations on altered phlogopite from two of the kimberlites vary between 204±20 m.y. and 380±40 m.y. The phlogopite, therefore, crystallized much earlier than the time of emplacement of the kimberlite pipes and, in a sense, may be regarded as xenocrystic. Both the Ar-40 and total K content are low due to the altered nature of the phlogopite. The pre–emplacement ages are consistent with a low temperature of injection, possibly as low as 100°–200°C, which explains the lack of pyrometamorphic contact effects in the Permian country rocks.—Author's abstract

Brookins, Douglas G. *See* Dyer, Roger G. 00408

00414 **Brookins, Douglas G.** Riley County, Kansas kimberlites and their inclusions [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South–Central Sec., p. 4, 1969.

00581 **Brown, E. H.** Petrogenesis of a talc body in the North Cascades, Washington [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 63, 1969.

00415 **Brown, L. F.; Goodson, J. L.** Sedimentary versus contemporaneous tectonic control of fluviatile–deltaic deposition [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South–Central Sec., p. 4, 1969.

06541 **Brown, Ralph Edward.** A multi–layered finite element model for predicting mine subsidence [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2060B, 1968.

Brown, Walter R. *See* Pessagno, Emile A., Jr. 00499

00434 **Brown, Wilton J.** Bloodworth Northeast field, Coke and Nolan Counties, Texas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 209, 1969.

06566 **Brunskill, Gregg John.** Fayetteville Green Lake, New York—[Pt.] 1, Physical and chemical limnology; [Pt.] 2, Precipitation and sedimentation of calcite in a meromictic lake with laminated sediments [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2104B–2105B, 1968

00551 **Bryan, W. B.; Finger, L. W.; Chayes, F.** Estimating proportions in petrographic mixing equations by least-squares approximation: Science, v. 163, no. 3870, p. 926–927, table, 1969.

Petrogenetic hypotheses involving fractional crystallization, assimilation, or mixing of magmas may be expressed and tested as problems in least-squares approximation. The calculation uses all of the data and yields a unique solution for each model, thus avoiding the ambiguity inherent in graphical or trial-and-error procedures. The compositional change in the 1960 lavas of Kilauea Volcano, Hawaii, is used to illustrate the method of calculation.—Authors' abstract

Bubb, John N. *See* Mitchum, Robert N. 00430

06562 **Buchbinder, Goetz Gustav Rudolf.** Properties of the core-mantle boundary and observations of PcP [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2093B, 1968.

00583 **Buchwald, V. F.** Iron meteorites—Tables relating the Widmanstätten angles to the plane of section: Geochim. et Cosmochim. Acta, v. 33, no. 1, p. 152–153, illus., table, 1969.

Leonhardt's mathematical solution of the problem of orienting arbitrary sections through iron meteorites by means of the angles in the Widmanstätten structure has been extended. Computer calculated solutions of 1800 different orientations have been obtained in table form. The tables should be of interest also to crystallographers working with cubic crystals.—Author's abstract

Buell, Helen F. *See* Buell, Murray F. 06705

06705 **Buell, Murray F.; Buell, Helen F.; Reiners, W. A.** Radial mat growth on Cedar Creek Bog, Minnesota: Ecology, v. 49, no. 6, p. 1198–1199, illus., 1968.

At Cedar Creek Bog, Anoka County, Minn., the bog mat was surveyed in 1934 and a permanent transect was made from an upland bench mark to the water's edge. Reexamination at irregular intervals, the last in 1967, revealed that after 33 years the position of the mat margin was essentially unchanged, but the width of the vegetation zones had changed. The larch-shrub zone had expanded toward the water, greatly reducing the sedge mat, which was kept trimmed by erosion of the waterward edge. It is concluded that lake-bog succession does not proceed through an orderly development of vegetation zones. Concentric zones surrounding open water may expand and contract under changing conditions; fluctuating water levels and, indirectly, climatic changes are probably the most important variables.—VMJ

06472 **Bull, Colin; Marangunic, Cedomir.** Glaciological effects of debris slide on Sherman Glacier, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 309–317, illus., table, 1968.

In the Chugach Mountains of south-central Alaska, 35 km northeast of Cordova, the earthquake of March 1964 triggered a debris slide that covered 8.5 km^2 of the ablation area of Sherman Glacier. The debris sheet, acting as an insulating layer, has reduced the annual ablation of the glacier by 40 percent, changing the mass balance from slightly negative to strongly positive. The glacier is now gaining about 2.7×10^{13} g annually. In 1966, surface velocities on the lower half of the glacier were increasing toward the snout; this and the change in the strain pattern in the

slide area indicate that the glacier was already responding to the change in regime. The glacier terminus, however, was still receding in 1966.—*from* Authors' abstract

Bull, Colin. *See* Marangunic, Cedomir. 06479

06528 **Bullock, Peter.** The zone of degradation at the eluvial–illuvial interface of some New York soils [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 1900B, 1968.

00615 **Burk, Cornelius F., Jr.** Towards a national system for geoscience data: Oilweek, v. 19, no. 50, p. 38–40, 48, 1969.

The National Advisory Committee on Research in the Geological Sciences commissioned a special ad hoc committee of Canadian scientists to develop a concept for a computer-oriented national system for storage and retrieval of geoscience data; its final report was published in 1967. The system is envisaged as a network of independent owner-controlled computerized data files, and would include a national index to sources of data. A permanent Secretariat established in 1968 will coordinate development and operation. Work begun on the Canadian Index to Geoscience Data in 1967 will be enlarged gradually by contributions from organizations wishing to participate. Three projects to develop data files deal with the geology of mineral deposits, a fourth with oil and gas, and a fifth with field observations.—ESL

06572 **Burke, K. B. S.** A seismic study of the surficial deposits in the Stenen area, Saskatchewan: Canada Geol. Survey Paper 68–60, 36 p., illus., table, 1968.

Beneath glacial lake silt, a bedrock depression filled with sand, gravel and till was delineated by test drilling. Uphole wavefront diagrams from detonations show a velocity inversion at the bedrock surface: 6,000 ft/sec in till and 7,000–8,000 in sand and gravel, cf. 5,000 ft/sec in shale. Two correlation refraction profiles lack secondary arrivals from surficial deposits, but have consistent reflections from within bedrock horizons. Thus, seismic refraction is useless to map bedrock surface. The sand and gravel may be located beneath a continuous refraction profile, but head waves from till and those from sand and gravel cannot be distinguished by frequency and amplitude characteristics; frequency content seems to be a function of shotpoint lithology. Maximum increase in thickness of the depression fill, 170 feet calculated by a time lead in reflection, nearly agrees with the 150 feet estimated from drilling.—GDC

06581 **Burns, Roger G.; Prentice, F. J.** Distribution of iron cations in the crocidolite structure: Am. Mineralogist, v. 53, nos. 5–6, p. 770–776, illus., tables, 1968.

Measurements have been made of the fundamental band of the O–H stretching frequency in three crocidolites of the alkali amphibole series. Several sharp peaks and prominent inflections are observed in the spectra, which correspond to hydroxyl groups linked to divalent Fe and Mg, and trivalent Fe ions in all possible distributions in the two M(1) and one M(3) positions of the amphibole structure. Peak intensities have been used to estimate site populations in each crocidolite. Trivalent Fe ions are enriched in M(2) positions, but a small proportion also occurs in M(1) and M(3) positions with relative enrichment in M(1) positions. The majority of divalent Fe ions occupy M(1) and M(3) positions with relative enrichment in M(1) positions. The results indicate that local charge balance controls the distribution of trivalent Fe ions in the crocidolite structure.—Authors' abstract

06364 **Busby, Mark W.** Flow, quality, and salinity in the Hudson River estuary, *in* Hudson River ecology—Symposium, 1966, Tuxedo, N.Y.: [Albany] Hudson River Valley Comm. New York, p. 135–146, illus. [1968?].

Fresh water enters the system in three units, the upper Hudson (4,260 sq mi) basin, the Mohawk basin (3,460 sq mi), and the lower Hudson basin (5,320 sq mi). The flow totals about 21,700 cfs. The influence of the tide is described, and the methods of measuring its influence are discussed.—HRC

00381 **Caine, N.** A model for alpine talus slope development by slush avalanching: Jour. Geology, v. 77, no. 1, p. 92–100, illus., 1969.

Field studies indicate that at least two processes operate to form talus slopes in alpine zones. Direct fall from cliff faces concentrates waste near the talus head. Slush avalanches carry down waste from gullies in cliffs and also rework material from the upper part of the talus; the avalanches concentrate material near the talus foot. The model treatment indicates that these two processes are adequate to explain the measured profiles. Concavity of the lower part of the profiles is attributed to the effects of avalanche deposition.—DRM

Caldwell, R. L. *See* Givens, W. W. 06515

00599 **California Div. Mines and Geology.** California mining review—What happened in 1968: California Div. Mines and Geology Mineral Inf. Service, v. 22, no. 2, p. 19–27, illus., 1969.

This review of mining and minerals industry activities includes observations made by staff geologists during the first ten months of 1968. Sections include the metals—copper, gold, lead–zinc, mercury, silver, tungsten, and uranium; geothermal resources; industrial minerals—gypsum, limestone, magnesium, phosphate, gravel, sulfur, and talc; and petroleum and natural gas. Some exploration and a few new discoveries are described briefly, but the emphasis is on industrial operations.—GDC

06463 **Calvo, C.** The crystal structure of graftonite: Am. Mineralogist, v. 53, nos. 5–6, p. 742–750, illus., tables, 1968.

The crystal structure of graftonite, $(Fe,Mn,Ca,Mg)_3(PO_4)_2$, from Grafton, New Hampshire, was determined by single-crystal X-ray diffraction methods. The lattice parameters are $a = 8.91$ (1), $b = 11.58$ (1), $c = 6.239$ (8) A, $\beta = 98.9$ (1), $Z = 4$; space group $P2_1/c$. The structure is composed of chains of trigonal bipyramidal cation polyhedra running parallel to the c axis formed through edge-sharing. Seven coordinated cations occur in edge-shaped pairs which are corner shared with similar groups to form sheets in the bc plane while the remaining cation polyhedra join these sheets with the chains. In the three cation polyhedra found, in two the cations have five-fold coordination while for the third the coordination number is seven.—*from* Author's abstract

06374 **Calvo, Crispin.** The crystal structures of some divalent metal ion phosphates, *in* Colloque international sur les phosphates minéraux solides, Toulouse, 1967—V. 1, Structure et propriétés des phosphates: Paris, Soc. Chim. France, p. 98–101, tables, 1968.

The results of a number of crystallographic and related studies on anhydrous divalent metal ion phosphate systems are summarized. Structures and phase relationships among the orthophosphates (graftonite-type), and structures and phase transformations of the pyrophosphates (thortveitite-type) are considered and discussed.—ESL

00542 **Campbell, Ian.** "Mene, mene, tekel, upharsin": Geol. Soc. America Bull., v. 80, no. 4, p. 553–560, illus., 1969.

The "writing on the wall" as translated means "they have numbered, and numbered, and weighed, and still they divide." For the Geological Society of America, membership is increasing, abstracts are increasing, and "still they divide." There are now seven Associated Societies, six Sections, and four Divisions in what was once a single Society. With the necessity for enlarged programs, participants are faced with inevitable and increasing conflicts of interest. But the Society's concern must reach beyond internal matters. There is urgent need to carry our science to the people. The challenge is nothing less than to assure, through citizen understanding and appreciation, that geology is brought into the decision-making process at every step in determining the manifold use of this our land—land which as population "explodes" grows ever more valuable. Truly, such a goal should become part of GSA's manifold destiny. This then is "the writing on the wall."—CCC

06714 **Canada Dept.Energy,Mines,Resources.** (Surveys and Mapping Branch). Lakes, rivers and glaciers: Ottawa, Ontario, Canada Dept. Energy, Mines and Resources, scale 1:7,500,000, 1968.

00387 **Canada Geological Survey.** Report of activities—Pt. A, April to October, 1968: Canada Geol. Survey Paper 69–1, pt. A, 263 p., illus., tables, 1969.

This report, containing 153 short papers, many illustrated by page-size maps and figures, presents the preliminary results of field work undertaken by members of the Geological Survey of Canada in 1968 [in the fields of Appalachian geology, coal research, continental margins, Cordilleran geology, engineering and indicator geology, geochemistry, geomorphology and sedimentology, geophysics, mineral deposits, paleontology, petrology, Precambrian geology, Quaternary geology, stratigraphy and structural studies, and general].—Author's abstract

06406 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 E/2, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3823, scale 1:63,360, 1968.

06407 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 E/7, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3824, scale 1:63,360, 1968.

06408 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 E/10, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3825, scale 1:63,360, 1968.

06409 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 E/15, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3826, scale 1:63,360, 1968.

06410 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 L/2, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3827, scale 1:63,360, 1968.

06411 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 L/7, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3828, scale 1:63,360, 1968.

06412 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 L/10, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3829, scale 1:63,360, 1968.

06413 **Canada Geological Survey.** Aeromagnetic series, Winino Creek, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3830, scale 1:63,360, 1968.

06414 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 M/2, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3831, scale 1:63,360, 1968.

06415 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 M/7, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3832, scale 1:63,360, 1968.

06416 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 M/10, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3833, scale 1:63,360, 1968.

06417 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 M/15, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3834, scale 1:63,360, 1968.

06418 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 E/1, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3835, scale 1:63,360, 1968.

06419 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 E/8, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3836, scale 1:63,360, 1968.

06420 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 E/9, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3837, scale 1:63,360, 1968.

06421 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 E/16, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3838, scale 1:63,360, 1968.

06422 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 L/1, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3839, scale 1:63,360, 1968.

06423 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 L/8, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3840, scale 1:63,360, 1968.

06424 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 L/9, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3841, scale 1:63,360, 1968.

06425 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 L/16, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3842, scale 1:63,360, 1968.

06426 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 M/1, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3843, scale 1:63,360, 1968.

06427 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 M/8, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3844, scale 1:63,360, 1968.

06428 **Canada Geological Survey.** Aeromagnetic series, Wood Creek, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3845, scale 1:63,360, 1968.

06429 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 M/16, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3846, scale 1:63,360, 1968.

06430 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 F/3, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3878, scale 1:63,360, 1968.

06431 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 F/6, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3879, scale 1:63,360, 1968.

06432 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 F/11, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3880, scale 1:63,360, 1968.

06433 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 F/14, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3881, scale 1:63,360, 1968.

06434 **Canada Geological Survey.** Aeromagnetic series, Pine Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3882, scale 1:63,360, 1968.

06435 **Canada Geological Survey.** Aeromagnetic series, Spruce Lake, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3883, scale 1:63,360, 1968.

06436 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 K/11, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3884, scale 1:63,360, 1968.

06437 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 K/14, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3885, scale 1:63,360, 1968.

06438 **Canada Geological Survey.** Aeromagnetic series, Sheet 43 N/3, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3886, scale 1:63,360, 1968.

06439 **Canada Geological Survey.** Aeromagnetic series, Winisk, District of Kenora, Ontario: Canada Geol. Survey Geophysics Paper 3887, scale 1:63,360, 1968.

06440 **Canada Geological Survey.** Ship magnetometer series, Sheets 20 O/1, 2, 6–11, 14–16, East and West, Scotian Shelf: Canada Geol. Survey Geophysics Papers 5324–5342, scale 1:31,680, 1968.

06765 **Canada Geological Survey.** Aeromagnetic series, Sheet 76 K/3 and 76 K/4, District of Mackenzie, Northwest Territories: Canada Geol. Survey Geophysics Paper 3622, scale 1:63,360, 1968.

06712 **Cardwell, Dudley H.; Erwin, Robert B.; Woodward, Herbert P.** (compilers). Geologic map of West Virginia: Morgantown, W. Va., West Virginia Geol. and Econ. Survey, 2 sheets, scale 1:250,000, sections, text, 1968.

Tectonic, systemic, and basement maps are inset on the 'west sheet' with brief explanations of each. Columnar and interpretive cross sections, and a correlation chart are included.—MCM

Carles-Gibergues, A. *See* Aitcin, P. C. 06777

00416 **Carlson, Marvin P.** Basement rock distribution and paleotopography in western Nebraska [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 5, 1969.

06504 **Carothers, James E.** A statistical study of the formation factor relation: Log Analyst, v. 9, no. 5, p. 13–20, illus., 1968.

Results of a statistical study of measured formation factor data are presented; 981 measurements, 793 in sandstones and 188 in carbonates, were used. When all sandstone formation factors versus porosity values are plotted, the abundance of data obscures a single line relation; however, if data are averaged and plotted, the following general formation factor–porosity relation is observed: $F = 1.45/\phi^{1.45}$. By averaging all points which have values higher than this relation and all points with lower values, it can be assumed that the higher slope represents calcareous sands and the lower shaly sands. Plots of data from sands of various ages show agreement with this relation. For carbonate rocks, two straight line relations are found: the apparent best fit of data, $F = .85/\phi^{2.14}$; and a forced fit of data, $F = 1/\phi^{2.04}$.—VSN

06664 **Carpenter, G. L.** Oil development and production in Indiana during 1966: Indiana Geol. Survey Mineral Economics Ser. 13, 19 p., illus., tables, 1968.

A decline in both drilling and production of primary oil took place in Indiana during 1966. The number of wells drilled in 1966 was 794, 68 fewer than in 1965. Oil production amounted to 10.6 million bbl in 1966, a decline of 800,000 bbl from 1965 production. Indiana oil-field statistics for 1966 are tabulated.—KAF

06665 **Carpenter, G. L.; Keller, Stanley J.** Oil development and production in Indiana during 1967: Indiana Geol. Survey Mineral Economics Ser. 14, 17 p., illus., tables, 1968.

A decline in both drilling and production of primary oil took place in Indiana during 1967. The number of wells drilled decreased from 794 in 1966 to 725 in 1967. Oil production was approximately 10 million bbl, a decline of around 500,000 bbl from 1966. Indiana oil-field statistics for 1967 are tabulated.—KAF

Carter, Neville L. *See* Dieterich, James H. 00471

00417 **Case, J. E.** Gravity interpretation of concealed Precambrian rocks near the Llano uplift, Texas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 5–6, 1969.

06780 **Černý, P.** Comments on serpentinization and related metasomatism: Am. Mineralogist, v. 53, nos. 7–8, p. 1377–1385, 1968.

In highly metamorphosed regions, alpine peridotites are serpentinized after consolidation of the enclosing siliceous rocks, under much lower p–T conditions than existed during the preceding regional metamorphism. Magnesium outflow during an essentially equal volume serpentinization often causes chloritization of surrounding rocks. On the other hand, in low-grade metamorphic and sedimentary environment serpentinization takes place during the tectonic emplacement of ultramafic bodies and yields rodingite and jadeite zones that were produced by calcium outflow from completely serpentinized ultramafites. Some contact reactions of "cold-intrusive" ultramafites with adjacent siliceous rocks take place above the serpentinization p–T range and some within its limits.—*from* Author's abstract

Chave, Keith E. *See* Smith, Steven V. 00363

Chayes, F. *See* Bryan, W. B. 00551

06544 **Chen, Pei-Yuan.** Geology and mineralogy of the white bentonite beds of Gonzales County, Texas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2084B, 1968.

06615 **Cheney, E. S.; Vredenburgh, L. D.** The role of iron sulfides in the diagenetic formation of iron-poor manganese nodules: Jour. Sed. Petrology, v. 38, no. 4, p. 1363–1365, illus., 1968.

Iron-poor manganese nodules form diagenetically. Under reducing conditions protonodules dissolve; some iron is fixed in sulfide minerals, but manganese migrates up to the oxidized zone and reprecipitates as iron-poor nodules.—Authors' abstract

06493 **Chesterman, Charles W.** Volcanic geology of the Bodie Hills, Mono County, California, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 45–68, illus., geol. maps, 1968.

Pliocene formations, all volcanic, overlying early Paleozoic(?) and middle Triassic(?) sedimentary rocks and Cretaceous granitic rocks in the Bodie Hills are (oldest to youngest): Rancheria Tuff Breccia (revised name), mainly dacitic; Murphy Spring Tuff Breccia (new name), dacitic pyroclastic rocks with dacite and rhyolite flows; Willow Springs Formation (revised name), dacite flows and tuff breccias, rhyodacite and rhyolite flows; Mt. Biedeman Formation (revised name), rhyolite to basalt flows and tuff breccia; and Potato Peak Formation (revised name), andesite flows. The dominate structural features are the Big Alkali caldera (described here), a small circular collapse structure, and the Mt. Biedeman dome, a volcanic pile of basaltic and andesitic pyroclastics.—*from* Author's abstract

06631 **Chinnery, Michael A.** Earthquake magnitude and source parameters [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 13, 1968.

Christensen, M. N. *See* Gilbert, C. M. 06355

00577 **Christensen, N. I.; Crosson, R. S.** Preferred olivine orientation and seismic anisotropy [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 62 [!61], 1969.

06529 **Christenson, Donald Robert.** Magnesium release and uptake from selected Michigan soils [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 1900B–1901B, 1968.

06743 **Chung, K. S.; Beamish, F. E.** Direct determination of submicrogram amounts of osmium and ruthenium in sulphide ores by neutron activation analysis [with French and German abs.]: Anal. Chim. Acta, v. 43, no. 3, p. 357–368, illus., tables, 1968.

A neutron activation method, involving a radiochemical separation based upon two consecutive distillations, is described for the direct determination of nanogram amounts of osmium and ruthenium in selected sulphide ores. A loss of osmium due to volatilization occurred when the tracer solution was evaporated. A simple radiochemical method using iron (III) hydroxide precipitation was devised to prevent this loss. The proposed method was applied to ores expected to contain only traces of platinum metals. The addition of the active carrier was found to improve the separation of these two metals in the submicrogram range, although, no chemical yield determination was necessary.—Authors' abstract

06645 **Church, Norman K.** Lithostratigraphy and petrology of the Bertram Member of the Wapsipinicon Formation (Devonian) in east-central Iowa: Iowa Acad. Sci. Proc. 1967, v. 74, p. 168–177, illus., 1968.

Rock samples were collected from the Bertram Member of the Wapsipinicon Formation in six quarries in Linn County, Iowa. Polished sections and thin sections were made of selected samples and were studied by use of binocular and petrographic microscopes. Sample cuttings from selected wells in east-central Iowa were studied for the presence of Bertram lithologies. An isopachous and paleogeologic map of Bertram strata was prepared from the data obtained from surface and subsurface samples. Prior to Bertram deposition east-central Iowa was exposed to subaerial erosion. The first sediments of the Middle Devonian transgressive sea were deposited on a supratidal mudflat which was occasionally flooded by abnormally high tides, as evidenced by the presence of very fine-grained dolomites, dessication features, traces of gypsum, intraclasts and scattered sand grains.—Author's abstract

Churkin, Michael, Jr. *See* Brabb, Earl E. 00484

Cifelli, Richard. *See* Thompson, Geoffrey. 06600

Clabaugh, S. E. *See* Dasch, E. J. 00404

06545 **Clanton, Uel S., Jr.** Sorption and release of strontium-89 and cesium-137 by recent sediments of the Guadalupe River of Texas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2085B, 1968.

06546 **Clark, Allen LeRoy.** Wall rock alteration and trace element distribution in the Galena mine, Shoshone County, Idaho [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2085B, 1968.

06462 **Clark, Joan R.; Papike, J. J.** Crystal-chemical characterization of omphacites: Am. Mineralogist, v. 53, nos. 5–6, p. 840–868, illus., tables, 1968.

The results of a crystal-structure refinement of California P2 clinopyroxene omphacite show that the cation distribution is largely ordered, (Mg,Fe^{2+})-octahedra alternating with (Al,Fe^{3+})-octahedra in the octahedral chains, and the larger polyhedra alternating in contents between major Na and major Ca. The presence of sufficient octahedrally coordinated Al to initiate the ordering process is considered necessary to obtain P2 omphacite. Appearance of P2 omphacites in blueschist facies at widely separated localities along the Circumpacific mountain belt suggests that these omphacites form at the low temperature–high pressure conditions considered characteristic of this facies of metamorphism.—*from* Authors' abstract

Clark, Joan R. *See* Papike, J. J. 06768

06547 **Clark, Sandra Helen Becker.** Structure and petrology of the Priest River–Hoodoo Valley area, Bonner County, Idaho [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2085B–2086B, 1968.

Clay, C. S. *See* Sanders, John E. 06391

Clayton, Lee. *See* Tuthill, Samuel J. 06473

06628 **Clebnik, Sherman M.** An attempted correlation between the occurrence of *Mya arenaria* and substrate texture near Parrsboro, Nova Scotia [abs.]: Maritime Sediments, v. 4, no. 2, p. 54, 1968.

06602 **Coakley, J. P.; Rust, B. R.** Sedimentation in an Arctic lake: Jour. Sed. Petrology, v. 38, no. 4, p. 1290–1300, illus., tables, 1968.

The water of Stanwell-Fletcher lake, on Somerset Island, is essentially isothermal, with melting of ice only in the summer and only along the edges. Sedimentation is very slow because of the short season of inflow and the low organic activity. Silty sand derived from river bed loads accumulates on shallow marginal deltas and shelves. The sediment is poorly sorted because ice cover prevents wave action and removal of the fine material to deeper water. Mud, derived largely from river suspended loads, settles slowly in the central part of the lake. Faint laminae in the shelf sediments may be varves, but the deep water mud is structureless. The oxidation–reduction boundary in the sediments is at 5–20 cm, deeper than in temperate lakes, because of oxidation at the lake bottom and slower reduction within the sediment.—*from* Authors' abstract

06494 **Coats, Robert R.** The Circle Creek Rhyolite—A volcanic complex in northern Elko County, Nevada, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 69–106, illus., tables, geol. map, 1968.

The Circle Creek Rhyolite is a multiple-source mass of fayalite–ferro–augite rhyolite, forming an extensive complex in northern Elko County, Nev., with a diameter of about 8 miles and an exposed area of about 36 sq mi. From the structure of the flow layering and the complex sequence of microbrecciation structures, it seems to be a relatively thick mass that rose passively through many fissures to flood a sag basin in the older rocks, which are as young as the early Pliocene Idavada Volcanics, a sequence of ignimbrites and tuffs. Chemical analyses, thin-sections, and X-ray diffractometer studies show that the Circle Creek Rhyolite is a two-feldspar rhyolite. The interrelations of the pyroxene phases are unusually complex. The Circle Creek is partly concealed by later tuffs, gravels, and olivine basalt and is cut by two sequences of high-angle faults of different ages.—Author's abstract

06498 **Coats, Robert R.; Hay, Richard L.; Anderson, Charles A.** (editors). Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, 678 p., illus., tables, 1968.

This book, in honor of Howel Williams on the occasion of his 70th birthday, comprises 17 papers (cited separately) which review studies of ancient and active volcanoes in the western United States, Alaska, Hawaii, and Tahiti.—VSN

Cole, T. J. S. *See* Shafiqullah, M. 06360

06402 **Colwell, Robert N.** Determining the usefulness of space photography for natural resource inventory, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 249–289, illus., 1968.

The procedure for determining the usefulness of space photography for geographic studies is given. Examples of the uses of Gemini photography in mapping vegetation, soils, and geologic structures are shown.—GWL

Condon, William H. *See* Hoare, Joseph M. 06353

00485 **Coney, Peter J.** Gravitational tensional folding and tectonic denudation—Discussion (of paper by Ernst Cloos, 1968): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 433–435, illus., 1969.

Cloos' (ibid., v. 52, p. 420–444, 1968) paper on the concept of down-basin gravitational sliding of sedimentary prisms to explain the pattern of Gulf Coast faults may offer a possible solution to the problem of "tectonic denudation" (de Sitter, 1964, p. 239). In areas where the mechanism of gravitational sliding may have been operative, belts of superficial foreland folding and thrust faulting may have developed. On associated uplifts, areas of tensional spreading along many gravity faults may have occurred rather than denudation. Extension on the uplift would match shortening by thrust faulting and folding in the foreland areas.—SEF

Connell, J. G. *See* Tixier, M. P. 06513

06495 **Cook, Harry E.** Ignimbrite flows, plugs, and dikes in the southern part of the Hot Creek Range, Nye County, Nevada, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 107–152, illus., table, 1968.

The 15,000 feet of Oligocene continental sedimentary and volcanic rocks in this area include ignimbrite flows, plugs and dikes, lavas, and air-fall tuffs. The textures, structural features, and compositions of the various ignimbrite bodies are described. Ignimbrite plugs are modally and chemically 'stratified'; the origin of these variations is not well understood but possibly the basal portion of a differentiating magma chamber was tapped so that the magma became progressively more siliceous and alkalic. Continued pulses of increasingly more siliceous material may have caused the 'stratification'. Compositions and textures were modified in most sheets following emplacement.—VSN

06580 **Cooper, Hilton H., Jr.; Bredehoeft, John D.; Papadopulos, Istavros; Bennett, Robert R.** The response of well-aquifer systems to seismic waves, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 122–132, illus., reprinted 1968; originally published 1965.

This paper is reprinted with minor changes from Jour. Geophys. Research, v. 70, no. 16, p. 3915–3926, 1965.—MCM

00418 **Cornell, William C.** Silicoflagellates as paleoenvironment indicators in the Modelo Formation (Miocene) [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 6–7, 1969.

06758 **Corpus Christi Geological Society; Eargle, D. H.; Quigley, Galen; Dempsey, R. J.** South Texas uranium—Field trip, 1968: Corpus Christi, Tex., Corpus Christi Geol. Soc., 62 p., illus., 1968.

The road log for the first day—Corpus Christi to San Antonio—led by Eargle and Dempsey, includes measured sections of the Eocene Whitsett Formation. That for the second day—Falls City to McLean No. 2 mine, near Oakville—led by Eargle and Quigley, includes three measured sections (Whitsett Formation, Catahoula Tuff, and alluvium), correlation of drill holes in the Jackson Group, and geologic sketch maps. Excerpts of a paper by A. D. Weeks and D. W. Eargle (1963) and a reprint of a paper by P. T. Flawn (1967) are cited separately.—GDC

Cox, Allan. *See* Hoare, Joseph M. 06353

00594 **Craig, Harmon.** Discussion [of paper by H. C. Helgeson, 1968]—Source fluids for the Salton Sea geothermal system: Am. Jour. Sci., v. 267, no. 2, p. 249–255, illus., table, 1969.

The proposal by Helgeson [ibid., v. 266, no. 3, p. 129–166, 1968] that the source fluid for the Salton Sea geothermal brine was interstitial connate Colorado River water in the sediments is evaluated quantitatively in terms of the dynamics of the

geothermal system and the isotopic composition of the various waters involved. Neither batch nor continuous evaporation processes operating on original interstitial water of present day Colorado River composition can produce the geothermal brine characteristics presently observed. The isotopic evidence indicates that the source fluid was meteoric water derived from local precipitation and circulating downward through the sediments.—Author's abstract

00576 **Cramer, Chris H.** A time lapse presentation of the earthquakes of Washington State 1952–1967 [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 61 [!62], 1969.

00402 **Cramer, Fritz H.** Possible climate dependability of Silurian acritarchs [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 7, 1969.

00403 **Cross, Aureal T.; Thompson, Gary G.** Factors significant in sedimentation of palynomorphs [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 7–8, 1969.

Crosson, R. S. *See* Christensen, N. I. 00577

00575 **Crosson, Robert S.** Anisotropic elasticity of crystalline aggregates [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 61, 1969.

00451 **Curry, James T.** Navajo Mine, supplying coal for energy needs of southwest [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 215, 1969.

06496 **Curtis, G. H.** The stratigraphy of the ejecta from the 1912 eruption of Mount Katmai and Novarupta, Alaska, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 153–210, illus., 1968.

Nine principal layers of tephra in the vicinity of Mount Katmai and Novarupta are products of the 1912 eruption. Five of them represent major explosive events, four of which unquestionably and the fifth probably originated at Novarupta. The major part of the great tuff flow in the Valley of Ten Thousand Smokes was emplaced after the first cataclysmic eruption of rhyolite tephra. Banded pumices indicate mixing of rhyolitic and andesitic magmas from chambers underlying Novarupta and the chain of Mounts Katmai, Trident, Mageik, and Martin. Only the topmost very fine tephra originated from Mount Katmai. The summit of Katmai collapsed slowly during the entire eruptive period and was supported by a magma column which did not erupt until activity ceased at Novarupta; the two conduits were probably connected until near the end of activity.—VSN

00389 **Cushing, Barry C.** Graveyard of prehistoric monsters: Our Public Lands, v. 19, no. 1, p. 8–9, illus., 1969.

A visitor's center has been opened at the Cleveland–Lloyd Dinosaur Quarry in central Utah. This area was one of the marshes remaining near the end of the dinosaur age, and many of the reptiles became mired in it along with their predators. The fossilized bones, buried under ash and sediments, were exposed by erosion; digging began in 1931. More than 10,000 bones have been taken from the quarry, from which 30 skeletons have been assembled. The visitors' center includes an *Allosaurus* skeleton, a mural showing the area 1,300,000 yr ago, and interpretive exhibits.—ESL

Cuttitta, Frank. *See* Raup, Omer B. 06787

Dalrymple, G. Brent. *See* Hoare, Joseph M. 06353

Dalrymple, G. Brent. *See* Doell, Richard R. 06579

Dalton, Frank E. *See* Koelzer, Victor A. 06667

00573 **Danes, Z. F.** Gravity exploration of the Cascade Mountains of Washington [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 61, 1969.

06380 **Darnley, A. G.; Fleet, M.** Evaluation of airborne gamma-ray spectrometry in the Bancroft and Elliot Lake areas of Ontario, Canada, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 833–853, illus., 1968.

Ground and airborne gamma-ray spectrometry measurements have been compared over two small areas of the Canadian Shield. The instrumentation, method of investigation, and corrections applied to the data are described briefly. The ground results are presented as radiometric contours, with intervals drawn at multiples of the area modes for K–40, Bi–214 and Tl–208. Ground and airborne results are compared in profile form, and close agreement is demonstrated. Intensity of radiation from outcrop and from overburden over the same rock type has been found to be similar. The fact that total radiation intensity is dominated by the contribution from overburden does not appear to be unduly deleterious to the application of airborne gamma-ray spectrometry to geological mapping..—*from* Authors' abstract

00404 **Dasch, E. J.; Armstrong, R. L.; Clabaugh, S. E.** Age of dike swarm and basin-range faulting in the Rim Rock country, Trans Pecos Texas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 8, 1969.

00405 **Davies, David K.** Some Jurassic environments and tectonics [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 8–9, 1969.

00406 **Davies, David K.** Centripetal turbidite sedimentation, Gulf of Mexico [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 9, 1969.

Davies, David K. *See* Ethridge, Frank G. 00410

Davies, David K. *See* Berg, Robert R. 00461

Davies, David K. *See* Ehrlich, Robert. 06734

06735 **Davies, David K.** Carbonate turbidites, Gulf of Mexico: Jour. Sed. Petrology, v. 38, no. 4, p. 1100–1109, illus., table, 1968.

Cores from the southern edge of the Gulf of Mexico abyssal plain show a vertical repetition of three members: a basal white or gray, medium calcilutite, 30 cm average thickness, commonly cross laminated and with an abundant shallow water benthonic fauna; a light olive-gray fine calcilutite, some 35 cm in average thickness, commonly bioturbated and consisting of a mixture of comminuted shells, micrite, and argillaceous lutite, and with both planktonic and shallow water benthonic faunas; and an olive gray–olive black argillaceous lutite, 50 cm average thickness, either bioturbated or structureless, and containing a scattered planktonic fauna. Deposition was from turbidity currents that originated on the Campeche Shelf followed by a period of abyssal plain sedimentation.—*from* Author's abstract

Davies, T. A. *See* Gealy, Elizabeth L. 00589

Davis, G. L. *See* Hart, S. R. 00540

06548 **Davis, Richard Arnold.** Mature modifications and dimorphism in selected late Paleozoic ammonoids [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2086B, 1968.

00491 **Davis, Stanley N.; Peterson, Frank L.; Halderman, Allan D.** Measurement of small surface displacements induced by fluid flow: Water Resources Research, v. 5, no. 1, p. 129–138, illus., table, 1969.

Fluid flow to wells produces strain that has been measured as horizontal, vertical, and rotational displacements of reference points fixed on the ground surface. Most linear displacements measured were between 1 and 100 microns, and angular displacements were a few microradians. Of the various devices used to make measurements, a horizontal extensometer proved to be the most accurate and versatile. Most measurements were made of effects produced by pumping wells

for 5 to 30 minutes. Such effects are almost entirely elastic, except in some geologically recent materials. Deflections of the land surface resembled the theoretical deflections caused by a point load on a plate of infinite extent resting on an elastic foundation. Significant horizontal strain was measured in all materials tested, suggesting that accepted equations for fluid discharge from wells might be modified for special conditions near the wells.—Authors' abstract

06448 **deAbeledo, M. E. J.; Galloni, E. E.; deBenyacar, M. A. R.** Electron diffraction data for some members of the metatorbernite group: Am. Mineralogist, v. 53, nos. 5–6, p. 1028–1033, 1968.

The unit-cell data for metazeunerite, $Cu(UO_2AsO_4)_2{\cdot}8H_2O$; metaheinrichite, $Ba(UO_2AsO_4)_2{\cdot}8H_2O$; and metanovaceckite, $Mg(UO_2AsO_4)_2 \cdot 4H_2O$, obtained using single crystal electron diffraction techniques are given.

deBenyacar, M. A. R. *See* deAbeledo, M. E. J. 06448

deCamp, Catherine Crook. *See* deCamp, L. Sprague. 06704

06704 **deCamp, L. Sprague; deCamp, Catherine Crook.** The day of the dinosaur: Garden City, N.Y., Doubleday and Co., 319 p., illus., 1968.

Written in popular vein, though not for children, this book traces the evolution of dinosaurs and related reptiles of the Mesozoic Era, and their relation to earlier and later forms of life, framed by a general background of historical geology. The dinosaurs are treated in roughly chronological order, with formal names, brief descriptions, geographic and stratigraphic occurrences, and to-the-point interpretations of biodynamics and paleoecology which, though necessarily conjectural, are based on available data and on comparisons with living animals. History of collecting, study, and restoration of dinosaurs, and history of theories of evolution are included. Most of the illustrations are simple sketches or photographs of restorations.—VMJ

06524 **Decker, R. W.; Wright, T. L.** Deformation measurements on Mauna Loa Volcano, Hawaii: Bull. Volcanol., v. 32, no. 2, p. 401, 1968.

Encouraged by the results obtained on Kilauea, deformation measurements have been started at Mauna Loa. Repeat leveling and horizontal observations across the summit crater to date show small changes (up to 5 ppm of inflation), only slightly larger than the expected error, and one or two orders of magnitude less than on Kilauea. Since the last eruption of Mauna Loa in 1950, Kilauea has had 14 eruptions. Whether the present strain repose of Mauna Loa represents an inflated or a collapsed state is not known.—DBV

06511 **deCosta, John.** Species diversity of chydorid fossil communities in the Mississippi Valley [with German abs.]: Hydrobiologia, v. 32, nos. 3–4, p. 497–512, illus., tables, 1968.

Species diversity and equitability component were calculated for the chydorid (cladoceran branchiopod) fossil populations from 45 natural, artificial, and oxbow lakes in the Mississippi Valley. *Chydorus sphaericus* was superabundant where diversity and equitability component were low, chiefly in the natural lakes. Populations were significantly greater for the natural lakes than for the artificial and oxbow lakes. Correlation of species diversity to population size was negative for the natural lakes, positive for the other two groups. Sedimentary parameters have a low mean value for natural lakes, high for the other two groups. It is suggested that the negative correlation of species diversity to sedimentary parameters in artificial and oxbow lakes is caused by the high turbidity in these lakes, which could retard cultural eutrophication.—VMJ

DeFord, R. K. *See* Underwood, James R., Jr. 00368

00475 **Deike, George H., 3d; White, William B.** Sinuosity in limestone solution conduits: Am. Jour. Sci., v. 267, no. 2, p. 230–241, illus., tables, 1969.

Caves were sampled from central Kentucky, Missouri, and various Appalachian and European reports. Caves that exhibited parallel uniform walls which did not branch in the measured reach were selected. Two types of nonlinearity were found: an angulate form generated by water flow down a hydraulic gradient diagonal to a rectangular joint set and a curvilinear form with sweeping S-bends apparently related to meanders in surface streams. The average bend spacing (L) and channel width (W) of the sinuous form are related by the power function $L = KW^n$. The coefficient K and the exponent n are respectively 6.8 and 1.05 for the Missouri caves and 8.2 and 0.92 for all other caves. The constants are similar to those proposed for alluvial rivers.—*from* Authors' abstract

06534 **Delfino, Joseph John.** Aqueous environmental chemistry of manganese [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 1947B, 1968.

Dellwig, L. F. *See* Wing, R. S. 00375

06386 **Dellwig, Louis Field; MacDonald, Harold C.; Kirk, J. Norman.** The potential of radar in geological exploration, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 747–764, illus., 1968.

Sidelooking, dual-polarization, airborne radars are most useful for regional studies of remote, previously unmapped areas, especially where aerial photography and ground investigations are not possible. Gross structural patterns and regional lineaments are emphasized by the continuous image of wide swaths of terrain and the low resolution which suppresses distracting detail. In detailed studies changes of lithology can be detected by examination of fracture textures, patterns of weathering, topography, and vegetation.—GWL

Dempsey, R. J. *See* Corpus Christi Geological Society. 06758

00407 **Denison, Rodger E.** Basement rocks in Oklahoma—A review [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 9–10, 1969.

Denison, Rodger E. *See* Lidiak, Edward G. 00522

Dennen, W. H. *See* Blackburn, W. H. 06781

06563 **Desai, Kantilal Panachand.** Sequential measurement of longitudinal and shear velocities of rock samples under triaxial pressure [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2093B–2094B, 1968.

00378 **DeVore, George W.** Preferred mineral distributions of polymineralic rocks related to non-hydrostatic stresses as expressions of mechanical equilibria: Jour. Geology, v. 77, no. 1, p. 26–38, illus., tables, 1969.

Recrystallization of a mineralogically heterogeneous rock under nonhydrostatic stress results in preferred mineral distribution as well as preferred mineral orientations. Maximum strain energy per unit stress is achieved if the minerals are arranged so as to give the modal composition of the rock in the direction parallel to the maximum compressive stress, and monomineralic layers parallel to the direction of applied shear stress. These mineral distributions produce the maximum work per unit stress, and the maximum decrease in the mechanical potential energy, and are regarded as the equilibrium arrays. They do not, however, provide minimum chemical potentials of the constituents of the strained minerals.—*from* Author's abstract

06614 **Dickas, A. B.; Lunking, W.** The origin and destruction of armored mud balls in a fresh-water lacustrine environment, Lake Superior: Jour. Sed. Petrology, v. 38, no. 4, p. 1366–1370, illus., table, 1968.

The evolution and destruction of armored mud balls in a fresh-water lacustrine environment have been studied for the first time. The triaxial ellipsoid mud core formed in this environment results from erosion of mud banks along the shore. The majority of the particles composing the veneer of the armor is added to the

core while it is in transit within the beach zone. After formation, storms throw the mud balls onto the beach. Depending upon the temperature prevailing at the time, the balls are soon destroyed, either by dessication or by frost heaving. To date, no fossil mud balls have been found in the recent sediments of Lake Superior.—Authors' abstract

00618 **Dickinson, William R.; Ojakangas, Richard W.; Stewart, Richard J.** Burial metamorphism of the late Mesozoic Great Valley Sequence, Cache Creek, California: Geol. Soc. America Bull., v. 80, no. 3, p. 519–525, illus., table, 1969.

In sandstones of the Great Valley Sequence of Mesozoic age at Cache Creek, postdepositional albitization of plagioclase and chloritization of biotite are widespread in noncalcareous rocks, but uncommon in rocks with calcareous cement. The degree of alteration increases systematically with age and inferred depth of burial in Upper Cretaceous strata, and is uniformly greater in Lower Cretaceous strata that were buried from 20,000 to 30,000 feet. Laumontite is characteristic of thoroughly altered Lower Cretaceous rocks. Other metamorphic assemblages may be widespread at higher and lower horizons.—Authors' abstract

Dickson, F. W. *See* Blount, C. W. 00564

00471 **Dieterich, James H.; Carter, Neville L.** Stress-history of folding: Am. Jour. Sci., v. 267, no. 2, p. 129–154, illus., 1969.

The velocity field and hence stress field for two-dimensional large-amplitude folding of a viscous layer in a less viscous matrix has been determined theoretically by a series of linear incremental problems. The velocity field for each problem was found numerically using a modification of the finite element method. The model considered most representative of natural folds had the following properties: η/η_1, (viscosity contrast) = 42, L/h (wavelength/thickness) = 12, A_0 (initial amplitude)=0.1h. Microstructures induced by intragranular flow of calcite and quartz have been used by many to determine principal stress orientations around natural folds of many styles and sizes, generally with similar results. Fabric data record *cumulative* intragranular flow during folding.—*from* Authors' abstract

00472 **Dieterich, James H.** Origin of cleavage in folded rocks: Am. Jour. Sci., v. 267, no. 2, p. 155–165, illus., 1969.

A numerical study of the slow, plane, finite deformation of a linearly viscous layer in a less viscous matrix is the basis of a theoretical study of the origin of cleavage in folded rocks. Comparison of theoretical fold geometries with natural fold geometries allows the stress and strain fields of the models to be compared with cleavage orientation. Patterns given by the directions perpendicular to the axis of the maximum principal compressive strain closely resemble axial-plane foliation in natural folds. Significantly, the differences in strain pattern between fold models agree with the observed variations of cleavage orientation in natural folds. It is concluded therefore that axial plane foliations form in response to total strain and develop perpendicular to the directions of maximum total shortening.—Author's abstract

00597 **Dietrich, Richard V.** Mineral tables—Hand-specimen properties of 1500 minerals: New York and London, McGraw-Hill Book Co., 237 p., tables, 1969.

These tables should aid the mineral collector, student, geologist, mining engineer, and others interested in mineral identification. The need to consult source and reference literature could enhance insight into mineral search and research. Three tables are given: two determinative, one of metallic, the other nonmetallic minerals; the third is based on chemical compositions. On the first two there is a subtable for each color.—GDC

Dill, R. F. *See* Shepard, F. P. 00482

06662 **Dimroth, Erich.** Sedimentary textures, diagenesis, and sedimentary environment of certain Precambrian ironstones [with German summ.]: Neues Jahrb. Geologie u. Paläontologie Abh., v. 130, no. 3, p. 247–272, illus., 1968.

Early Proterozoic ironstones of the Sokoman Formation in the Castignon–Romanet lake region, central Labrador trough, exhibit similarities to those of limestones. Four principal textural components are distinguished, and a textural classification similar to the textural classification of limestones is proposed. Effects of diagenesis are discussed, and it is pointed out that alteration was more intense in oxide ironstones than silicate–carbonate ironstones and in allochemical rocks than in orthochemical rocks. Deposition probably took place in a very shallow basin characterized by rapidly alternating quiet and turbulent hydrodynamic conditions with shifting mud and sand banks.—MS

06690 **Dineley, D. L.** Osteostraci from Somerset Island [with French abs.]: Canada Geol. Survey Bull. 165, p. 47–63, 32–43, illus., 1968.

Osteostracans are rare among the early vertebrate faunas of the Arctic Islands, but two excellent specimens of *Hemicyclaspis murchisoni* and several other fragments of cephalaspids are recorded from the lower part of the Lower Devonian Peel Sound Formation in northwestern Somerset Island.—Author's abstract

Dingman, Robert J. *See* Angino, Ernest E. 00420

06587 **Dinkelman, Menno G.** Migration of bedforms [abs.]: Maritime Sediments, v. 4, no. 2, p. 54, 1968.

06362 **Dionne, Jean-Claude.** Bibliographie du périglaciaire du Québec (A bibliography of periglacial studies in Quebec): Rev. Géographie Montreal, v. 22, no. 2, p. 175–180, illus., 1968.

A bibliography of 144 titles is given; the earliest one is dated 1934 and the most recent 1968. The bibliography is alphabetic by author, and no index is included.—HRC

00566 **Dodd, R. T.** Metamorphism of the ordinary chondrites—A review: Geochim. et Cosmochim. Acta, v. 33, no. 2, p. 161–203, illus., tables, 1969.

Textural variations among the ordinary chondrites are paralleled by mineralogical and chemical trends, most of which are consistent with the view that these chondrites have experienced various degrees of alteration in the solid state. On the basis of mineralogical and textural data, it is inferred that this alteration took place at temperatures of roughly 400° to more than 820°C, under low total pressures, in the absence of stress, and in a relatively dry environment. The mineralogical data do not indicate whether alteration took place during reheating of cold material or during cooling of a hot agglomerate. Alternative models which attribute the properties of the various chondrites to crystal–liquid–vapor interactions prior to accumulation find little support in the chondrites.—KAF

06579 **Doell, Richard R.; Dalrymple, G. Brent; Smith, Robert L.; Bailey, Roy A.** Paleomagnetism, potassium–argon ages, and geology of rhyolites and associated rocks of the Valles Caldera, New Mexico, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 211–248, illus., tables, 1968.

Paleomagnetic and potassium–argon studies support geologic evidence that the lower member of the Bandelier Tuff was deposited 1.4 m.y. ago. The upper member erupted about 1.0 m.y. ago and was followed by caldera collapse which formed the 12- to 14-mile diameter Valles Caldera. Post-caldera activity which resulted in the eruption of rhyolite domes and pyroclastic material, has occurred at about 0.9, 0.7, 0.5, and 0.4 m.y. ago, with later undated eruptions that were estimated at about 0.1 m.y. ago. These data from the Valles Caldera are the basis for the previously published age revision of the Brunhes–Matuyama geomagnetic polarity epoch boundary from 1.0 to 0.7 m.y. ago, and they were used to define the Jaramillo

normal polarity event at about 0.9 m.y. ago (Doell and Dalrymple, 1966).—Authors' abstract

Donahue, Jack. *See* Krinsley, David. 06727

06642 **Dorheim, Fred H.** Stratigraphic leak at Springville quarry: Iowa Acad. Sci. Proc. 1967, v. 74, p. 142–146, illus., 1968.

Lime Creek Shale, containing an Upper Devonian conodont fauna, is exposed below Middle Devonian rocks at a quarry near Springville, Iowa. The occurrence is interpreted as a stratigraphic leak and is cited as further evidence of this condition occurring in a karst Devonian terrain.—Author's abstract

Dorman, James. *See* Barazangi, Muawia. 06634

Dott, Robert H., Jr. *See* Baldwin, Brewster. 00592

Dugdale, R. C. *See* Forbes, Robert B. 00614

Duke, Michael B. *See* Finkelman, Robert B. 06453

00439 **Duncan, Robert L.** Energy resources of Rocky Mountain region [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 211, 1969.

06669 **Durrell, Richard H.** The Pleistocene geology of the Cincinnati area, reprinted *in* Sigma Gamma Epsilon, 1968 national convention, Cincinnati, Ohio—Handbook and guidebook: Cincinnati, Ohio, Sigma Gamma Epsilon, Alpha Delta Chapter, p. [42–56], illus., 1968; originally published 1961.

This paper was published originally in the Geological Society of America, Guidebook for field trips, Cincinnati meeting, 1961.—GDC

Dwornik, E. J. *See* Raup, Omer B. 06787

00408 **Dyer, Roger G.; Brookins, Douglas G.** Mineralogy and petrography of the Leonardville kimberlite, Riley County, Kansas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 10, 1969.

Dygas, Joseph A. *See* Smith, Steven V. 00363

00560 **Eardley, A. J.** Willard thrust and Cache uplift: Geol. Soc. America Bull., v. 80, no. 4, p. 669–679, illus., 1969.

The Willard thrust, exposed in the Wasatch Mountains for a distance of 20 miles, emplaces younger Precambrian strata on Paleozoic and older Precambrian rocks. In reconstructing the Late Mesozoic paleogeology a significant north-south uplift, here called the Cache, appears between the Willard thrust on the west and the Woodruff thrust on the east. It extends northward into Idaho and is somewhat like the Uinta Mountains uplift in size and shape. The south end is terminated by a fault that connects the Woodruff and Willard thrusts. The Willard thrust has the greatest observable displacement at the southwest corner of the uplift. Here also has been the greatest amount of uplift, where the Willard thrust sheet probably resulted. This hypothesis demands southwest translation and the geologic evidence supports the idea.—EHP

Eargle, D. H. *See* Corpus Christi Geological Society. 06758

Eargle, D. Hoye. *See* Weeks, Alice D. 06692

06689 **Earley, Charles F.; Goodell, H. G.** The sediments of Card Sound, Florida: Jour. Sed. Petrology, v. 38, no. 4, p. 985–999, illus., tables, 1968.

The presence of detrital quartz in Card Sound creates a dual-component sediment, with low-magnesium calcite being the predominant carbonate mineral, although some aragonite and high-magnesium calcite also occur. The sediments are poorly

sorted, and mean grain size and sorting decrease both down the long axis of the Sound and toward the Keys. The noncarbonate fraction is mainly well-sorted quartz, and both the amount and grain size decrease southwestward. The distribution of quartz in several size fractions shows that sediment transport is primarily by waves and wave-generated currents whose direction and magnitude are seasonal and, secondarily, by tidal currents. The facies change from a calcareous quartz sand to calcarenite is transitional over a 10-mile interval.—*from* Authors' abstract

06451 **Edgar, A. D.** Mineralogy of a zoned replacement body from the Blue Mountain litchfieldite, Peterborough County, Ontario: Am. Mineralogist, v. 53, nos. 5–6, p. 1048–1053, illus., 1968.

A spherical replacement body about 16 inches in diameter consists of five zones. Numbered from the core outward these zones consist of (1) biotite-cancrinite, (2) cancrinite-calcite-magnetite, (3) cancrinite-calcite-biotite, (4) calcite-analcite-natrolite, and (5) microcline-calcite, biotite. The specimen is believed to have formed metasomatically from the host rock (litchfieldite) by aqueous solutions rich in CO_3^{-2} and Cl^-. Changes proceeded from the outside inwards and involved transport of K^+ and Na^+ ions with a concommitant removal of silica.—BAM

06390 **Edgerton, A. T.** Engineering applications of microwave radiometry, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 711–724, illus., table, 1968.

Studies of the microwave characteristics of soils show that measured microwave temperatures are dependent on sensor frequency and polarization, and that differences in radiometric response of soils are due to differences in soil moisture content, particle size, and surface roughness. The dielectric properties are dependent on soil moisture content. Changes in the dielectric constant result in changes in the emissivity and radiometric brightness temperature. A qualitative relationship exists between radiometric brightness temperature and the bearing strength of soils.—GWL

Edmonds, Clarence S. *See* Bauleke, Maynard P. 06371

06745 **Edmunds, William E.** Geology and mineral resources of the northern half of the Houtzdale 15-minute quadrangle, Pennsylvania: Pennsylvania Geol. Survey, 4th ser., Atlas A85 ab, 150 p., illus., tables, geol. maps, 1968.

In central Clearfield County, Carboniferous stratigraphic units are the Pocono Formation, and the upper Pottsville, Allegheny and lower Conemaugh Groups, reflecting cyclic Pennsylvanian sea-level fluctuations. The Allegheny Group is here divided into five formations instead of three, informally using lower, middle, and upper Kittanning and restricting the Freeport; no sequence of lithologies is sufficiently persistent for subdivision except by genetic environments. The Laurel Hill anticline trending NE is flanked by the Houtzdale and Clearfield synclines; its folds are weak westward continuations of Valley and Ridge décollements, the later ones wrench faulted. Allegheny coal is the most important mineral resource; clay is second.—GDC

00520 **Ehmann, W. D.; McKown, D. M.** Instrumental activation analysis of meteorites using gamma-gamma coincidence spectrometry: Anal. Letters, v. 2, no. 1, p. 49–60, illus., tables, 1969.

A non-destructive procedure for the determination of iridium, sodium, nickel, cobalt, and scandium in a single meteorite sample is presented. The method utilizes neutron activation followed by gamma-gamma coincidence spectrometry. Iridium abundances are given for several meteorites and compared to values obtained by radiochemical separation methods. The non-destructive results differ significantly from previously published values for certain classes of meteorites, in particular the enstatite chondrites.—Authors' abstract

06734 **Ehrlich, Robert; Davies, David K.** Sedimentological indices of transport direction, distance, and process intensity in glacio-fluvial sediments: Jour. Sed. Petrology, v. 38, no. 4, p. 1166–1170, illus., 1968.

Volumetric abundance of various pebble types in the sediments at the terminus of Mendenhall Glacier, Juneau, Alaska can be used to determine direction of transport from source terrane and differences in energy flux between contrasted depositional environments. Both an increase in transport distance and in energy flux independent of distance result in a relative enrichment of mechanically strong detrital rock species. The general nature of functional relationships between the relative abundance of a detrital species and distance is greatly influenced by the spectrum of resistances associated with the assemblage and the variations in degradational energy affecting the detritus.—*from* Authors' abstract

Eldridge, J. S. *See* King, E. A., Jr. 00552

00409 **Elsik, William C.** An evaluation of *Engelhardtia* in the Gulf Coast Tertiary [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 10–11, 1969.

06640 **Elwell, James H.; Lemish, John.** Pop-outs in hematite colored concrete floor: Iowa Acad. Sci. Proc. 1967, v. 74, p. 117–12, 1968.

Pop-outs in a new basement floor that had been flooded and dried were traced to gray argillaceous shale in the concrete as fine aggregate. Shale particles in pop-outs had outer rims of colorless gel associated with alkali-silica reaction, surrounding a reaction zone containing red-brown hydrated ferric-oxide gel from oxidation of iron in the shale. Fresh shale particles from the aggregate source developed the reaction zones when placed in sodium hydroxide—evidence of instability of the shale in alkaline environment. The hematite dye particles were immobile in sodium hydroxide; in the concrete, the dye formed a red border defining the original surface of the shale particles; the reaction rims were developed entirely in the shale. Further study of interactions between the iron-oxidation and alkali-silica reactions is needed to explain the expansion mechanism.—VMJ

Emery, K. O. *See* Sanders, J. E. 00541

06604 **Emery, K. O.** Positions of empty pelecypod valves on the continental shelf: Jour. Sed. Petrology, v. 38, no. 4, p. 1264–1269, illus., tables, 1968.

The commonest and most stable position of empty valves of large pelecypods on the wave-washed zone of beaches is concave down; this position is due to the presence of fast currents and the absence or inadequacy of bioturbation. In contrast, most large pelecypod valves on the surface of the continental shelf lie in a concave up position in response to the action of carnivores and scavengers and to powerful bioturbation and the absence of fast currents. These observations of preferred position can be applied to paleoecological studies of ancient strata.—Author's abstract

06567 **Emmett, L. F.; Jeffrey, H. G.** Reconnaissance of the ground-water resources of the Missouri River alluvium between St. Charles and Jefferson City, Missouri: U.S. Geol. Survey Hydrol. Inv. Atlas HA-315, scale 1:125,000, sections, text, 1968.

Sand and gravel underlying the Missouri River flood plain between St. Charles and Jefferson City contain an abundant amount of water, which for the most part is unused. Both the steep bluffs bordering the flood plain and the bedrock are mainly dolomite with some limestone and sandstone; the trough in the alluvium consists of sand, gravel, silt, and clay. Ground water in the alluvial aquifer occurs under both unconfined and confined conditions, which vary geographically and in time; it is estimated that properly spaced wells would yield about 374 mgd. Water is predominantly a calcium bicarbonate type with significant amounts of magnesium and sulfate, and has a high hardness and iron content and a variable dissolved-solids content.—MCM

Emond, Pierre. *See* Morency, Maurice. 00530

06636 **Engdahl, E. R.; Flinn, E. A.** Upper mantle reflection of PKPPKP [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 17, 1968.

Erickson, B. *See* Malahoff, A. 00570

Erwin, Robert B. *See* Cardwell, Dudley H. 06712

00410 **Ethridge, Frank G.; Davies, David K.** Quartz as an indicator of depositional environment—An example from the Eocene (Claiborne) of Texas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 11, 1969.

06394 **Ewen, H. I.; Haneman, F.; Kalafus, R. M.; Louapre, M. E.; Mailloux, R.; Steinbrecher, D. H.** Microwave radiometric capabilities and techniques, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 9–58, illus., 1968.

The principles of operation and present capabilities of microwave radiometric sensors are presented. Separate sections are devoted to a discussion of antennas and radiometric receivers as the two major functional subsystems of the sensor. Projected capabilities offered by near future solid state component advances are included in the section on receivers.—Authors' abstract

Ewing, Maurice. *See* Jacobs, Marian B. 00549

Fabricand, Burton P. *See* Friedman, Gerald M. 06599

06612 **Fagan, John J.** Evidences of environment of deposition of red High Falls Shale, New York: Jour. Sed. Petrology, v. 38, no. 4, p. 1374–1377, illus., 1968.

Field investigation of the Silurian High Falls Shale at Pine Hill, New York, has yielded well-preserved *Lingula* specimens. The distribution of *Lingula* shells on the shale bedding planes suggests the action of gentle waves on tidal mud flats. High hematite content of the shales, shallow-penetrating mudcracks, and symmetrical ripplemarks are included among other evidence that the High Falls was deposited under littoral marine conditions.—Author's abstract

Fahey, Joseph H. *See* Ross, Clarence S. 06597

Falla, W. S. *See* Williams, E. G. 06595

06686 **Fan, S. S. T.; Yen, Yin-Chao.** Nonsteady one dimensional compressible fluid flow through anisotropic porous media: U.S. Army Materiel Command Cold Regions Research and Eng. Lab. Research Rept. 256, 13 p., illus., 1968.

The flow of a compressible fluid through a deep layer of a porous medium with nonuniform permeability was analyzed, its volumetric behavior described first by the perfect gas law, then by van der Waal's equation of state; Darcy's law was assumed to be valid. The model of air flowing through a deep bed of naturally compacted snow was used to carry out numerical computation; permeability of snow was considered as a function of depth. The nonlinear partial differential equation obtained by combining the continuity equation with Darcy's law was solved by finite difference technique, using a time dependent exponential decay boundary condition which included the step-rise constant boundary condition as a limiting case. Pressure distributions in the porous medium calculated from the assumption of ideal gas and van der Waal's gas were compared. Data were presented in dimensionless variables.—*from* Authors' abstract

06720 **Farrell, Thomas P.** Design and development of a hard-sediment propellant corer, *in* Marine sciences instrumentation, V. 4—Instrument Soc. America Symposium, 4th Natl., Cocoa Beach, Fla., 1968, Proc.: New York, Plenum Press, p. 675–681, illus., 1968.

This paper describes the design and operation of a light-weight, fast-driving, high-powered coring device. It successfully samples hard sand and sand-clay and also penetrates coral and rock. The coring mechanism utilizes a cable-lowered gun which, upon firing, drives a core barrel into the ocean bottom. Nylon lines connected between the gun barrel and the driven core barrel effect retrieval. Author's abstract

00447 **Fassett, James E.** Environment of deposition of Late Cretaceous Fruitland Formation coal deposits of San Juan Basin, New Mexico and Colorado [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 214, 1969.

06754 **Fauth, John L.** Geology of the Caledonia Park quadrangle area, South Mountain, Pennsylvania: Pennsylvania Geol. Survey, 4th Ser., Atlas 129a, 133 p., illus., tables, geol. map, 1968.

East to west are Precambrian rhyolites and basalts, Lower Cambrian sandstones and Cambrian–Ordovician carbonate rocks, all in greenschist facies of regional metamorphism. South Mountain changes trend to northeast near Caledonia Park with concentric and similar folds asymmetric to the northwest. Shear folds from the last stages of deformation (Late Devonian?) have downdip cleavage lineation. Structural axes are offset; blocks with different intensities of folding are separated by an early right-lateral transverse fault. The plunge and arcuate plan of folding resulted from longitudinal extension, longitudinal faults from stretching in overturned limbs or outward pressure within the narrowing core, and gravity collapse structures in response to secondary stress fields. Triassic faults truncated the structures.—GDC

06769 **Faye, G. H.; Manning, P. G.; Nickel, E. H.** The polarized optical absorption spectra of tourmaline, cordierite, chloritoid and vivianite—Ferrous-ferric electronic interaction as a source of pleochroism: Am. Mineralogist, v. 53, nos. 7–8, p. 1174–1201, illus., tables, 1968.

The polarized optical absorption spectra of tourmaline (blue-green), cordierite, chloritoid, and vivianite have been measured in the 7,000–30,000 cm^{-1} region. The spectra are discussed with relation to structure. The $Fe^{2+} \rightarrow Fe^{3+}$ interaction is suggested as among the more important and widespread causes of pleochroism in ferromagnesian silicates.—JLH

06505 **Fergusson, William B.; Prather, Bruce A.** Salt deposits in the Salina Group in Pennsylvania: Pennsylvania Geol. Survey, 4th ser., Bull. M 58 (Mineral Resources Rept.), 41 p., illus., 1968.

In Pennsylvania, where deep thick salt reserves are near adequate water supply and transportation, salt extraction by brining seems warranted. Depth to salt beds ranges from 2,200 feet in Erie County to 8,200 feet in Fayette County, and 8,900 feet in Bradford County with aggregate thickness from 80 to 543 to 776 feet, respectively. Correlation of the Salina Group to Michigan and Ohio shows that salt beds are contained within the stratigraphic units B, D, E, and F (Landes, 1945; Ulteig, 1964). Units B, D, and F salt are found in northwestern and north-central Pennsylvania, and F also in southwestern; unit E beds are thin and not extensive. Lithologic descriptions are correlated with New York. Salt deposition was restricted by the original environment imposed by reef structure in the Lockport Dolomite and the deltaic complex of the Bloomsburg Formation.—GDC

Fernando, C. H. *See* Ball, Ian R. 00606

Field, William O. *See* Tuthill, Samuel J. 06473

Finger, L. W. *See* Bryan, W. B. 00551

06453 **Finkelman, Robert B.; Duke, Michael B.** A technique for mounting, sectioning and polishing particles smaller than 30 microns in diameter: Am. Mineralogist, v. 53, nos. 5–6, p. 1056–1057, 1968.

The authors describe a technique for individually mounting and locating eight micron or larger particles in bakelite plugs preparatory to grinding and polishing. The technique produces a flat, polished surface for reflected light microscopy and electron microprobe analysis.—JSH

Finney, J. J. *See* Araki, T. 06788

00611 **Fischer, Alfred G.** Geological time-distance rates—The Bubnoff unit: Geol. Soc. America Bull., v. 80, no. 3, p. 549–551, illus., 1969.

The Bubnoff unit (B), defined as 1 micron/year = 1 mm/thousand years = 1 m/million years, is proposed as a standard measure for geologic movements and increments.—Author's abstract

06632 **Fischer, Joseph A.; Murphy, William J.** The earthquake factor in the design of major structures [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 14, 1968.

06454 **Fisher, D. Jerome.** Morinite-apatite-whitlockite—A correction [to 1960 and 1965 papers]: Am. Mineralogist, v. 53, nos. 5–6, p. 1060, 1968.

The (101) line with d = 4.04 belonging to low cristoballite should be the corresponding (111) line of $AlPO_4$ isotype of low cristobalite; similarly the d = 3.37 and 4.28 lines are the (102) and (100) lines of synthetic berlinite. The original papers were published in: ibid., v. 45, p. 645–667, 1960 and v. 50, p. 1658–1665, 1965.—VSN

06688 **Fisher, Richard V.; Mattinson, James M.** Wheeler Gorge turbidite-conglomerate series, California—Inverse grading: Jour. Sed. Petrology, v. 38, no. 4, p. 1013–1023, illus., 1968.

A coarse-grained sequence of turbidite-conglomerates at Wheeler Gorge, California, was deposited by a series of high-density, highly fluid underwater flows into deep water. Inverse grading is developed at the base of each conglomerate unit within the sequence, and one unit forcibly intruded shales to form graded sills. Reverse grading may in part be explained by Bernoulli's principle whereby pressures near the boundary of deposition tend to drive the large particles upward. The "Bernoulli boundary layer effect" may explain reverse grading in coarse-grained turbidite deposits, in mudflows, possible ignimbrite layers, and in igneous intrusions of the "Muskox type" which have boundaries that are finer grained than their interior parts.—*from* Authors' abstract

00586 **Flanagan, F. J.** U.S. Geological Survey standards—[Pt.] 2, First compilation of data for the new U.S.G.S. rocks: Geochim. et Cosmochim. Acta, v. 33, no. 1, p. 81–120, tables, 1969.

Rock analyses, determinations of major and minor constituents, and determinations of 57 trace elements reported by analysts throughout the world are presented for the new series of USGS rock samples [andesite AG-V1, basalt BCR 1, dunite DGS1, grano-diorite GSP1, peridotite PCC1, granite G2]. Averages for both the constituents generally reported in a rock analysis and the trace elements are given. Variances of the distributions of data by rock analysts for several oxides in G-2 are compared with similar variances for G-1.—Author's abstract

06728 **Flawn, Peter T.** Uranium in Texas, 1967, *reprinted in* South Texas uranium—Corpus Christi Geol. Soc., Field Trip, 1968: Corpus Christi, Tex., Corpus Christi Geol. Soc., p. 47–53, 1968; originally published 1967.

This paper was originally published as Texas Univ. Bur. Econ. Geology Geol. Circ. 67-1, 1967. *See* Abstracts of North American Geology for October 1967.—GDC

Fleet, M. *See* Darnley, A. G. 06380

00587 **Fleischer, Michael.** U.S. Geological Survey standards—[Pt.] 1, Additional data on rocks G-1 and W-1, 1965–1967: Geochim. et Cosmochim. Acta, v. 33, no. 1, p. 65–79, tables, 1969.

Analyses of samples G-1 and W-1 made between 1965 and 1967 have been collected and "best values" for many elements are suggested.—Author's abstract

Flinn, E. A. *See* Engdahl, E. R. 06636

Flinn, Edward A. *See* Harkrider, David G. 06648

00558 **Florin, Maj-Britt; Wright, H. E., Jr.** Diatom evidence for the persistence of stagnant glacial ice in Minnesota: Geol. Soc. America Bull., v. 80, no. 4, p. 695-704, illus., tables, 1969.

The basal organic deposit in many Minnesota lakes includes wood fragments and other coarse plant material of terrestrial origin, along with diatoms characteristic of soils, moss, and other terrestrial habitats. The material probably represents the floor of a superglacial forest; it is overlain by similar material deposited in shallow pools that formed when buried Wisconsin dead ice melted beneath a cover of till or outwash.—Authors' abstract

00554 **Folk, Robert L.** Toward greater precision in rock-color terminology: Geol. Soc. America Bull., v. 80, no. 4, p. 725-727, illus., 1969.

Use of the Munsell Soil Color Chart is advocated for rocks in the hue range of red, yellow, brown, and orange. This chart has six times as many color chips in this important range of rock colors as the Rock-Color Chart. A standardized value-chroma terminology is advocated, constant over all hues, such that each color chip has its own unique name, and the whole is tied together by a simple mnemonic device.—Author's abstract

06381 **Foote, R. S.** Application of airborne gamma-radiation measurements to pedologic mapping, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 855-875, illus., 1968.

An airborne system for rapidly gathering large volumes of gamma-radiation spectral data is being used to examine the uranium:thorium:potassium distribution in surface soils. Average soil types surveyed in the Atascosa County area, Texas, show a linear relationship between surface soil Tl-208 and Bi-214, which generally identifies the soil types. No correlations of Tl-208 and Bi-214 with K-40 are observed. Most of the region is observed to have an approximately constant radiation balance between Bi-214 and Tl-208 with the exception of two regional anomalies.—GWL

00614 **Forbes, Robert B.; Dugdale, R. C.; Katsura, T.; Matsumoto, H.; Haramura, H.** Dredged basalt from Giacomini Seamount: Nature, v. 221, no. 5183, p. 849-850, illus., table, 1969.

Angular blocks of basalt were dredged from the summit of Giacomini Seamount (lat 56°24′ N., long 146°34′ W.). Samples from the interiors of two blocks were chemically analyzed and found to be similar to rocks dredged from Hodgkins Bank Pinnacles in the Gulf of Alaska Seamount province; both are alkali basalts. This seems to extend the alkali basalt-seamount association to the northeastern Gulf of Alaska Seamount Province, and supports the view of Engel, Engel, and Havens (1965) that seamounts consist chiefly of alkali basalts or related variants.—DBV

06670 **Foreman, Helen P.** Upper Maestrichtian Radiolaria of California: Spec. Papers Palaeontology, no. 3, 82 p., illus., tables, 1968.

Most of the principal large taxa of radiolarians (including 8 new genera and 56 new species) of potential stratigraphic significance, are described from four localities in the Moreno Formation (Upper Cretaceous) in Fresno County. Analysis of their distribution and of material from other localities in California and elsewhere shows that very few species extend beyond a short transitional zone up into probable Eocene or down to the Lower Santonian.—MS

06700 **Fourmarier, P.** Arcs antillais et bassin canadien: Acad. Royale Sci. Outre-Mer Bull. Séances 1968-2, p. 392-415, illus., 1968.

The Antilles arcs, just as the Canadian basin, give the impression of being an advance of the Pacific into the Atlantic domain over the folded chains on the border of the Great Ocean. It seems extreme to seek in this an indication in favor of continental drift. Rather, the disposition of these structural units comes to the support of the thesis of the permanence and ancient age of the structural traits of the terrestrial crust.—Author's abstract, VSN

06354 **Fournier, Reba Benedict.** Mechanisms of formation of alaskite, aplite, and pegmatite in a dike swarm, Yosemite National Park, California, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 249–274, illus., tables, 1968.

Relations between textural variations and structural features in a complex, leucocratic dike swarm enclosed in the Half Dome quartz monzonite of the Sierra Nevada batholith indicate that alaskites, aplites, and pegmatites were produced by a continuous process in which the degree of saturation of the dike fluid with water played a decisive role. Important ramifications of this are: the dikes of upper Tenaya Canyon were emplaced by injection; during initial stages of dike formation, the magma was unsaturated with water, and leucocratic dike material crystallized as granitic-textured alaskite, where fluid remained unsaturated during crystallization; aplites resulted where leucocratic dike fluid became saturated with water; and granular pegmatite and very fine-grained felsitic aplite crystallized from the mobile, aqueous gas phase.—*from* Author's abstract

00610 **Fournier, Robert O.** Old Faithful—A physical model: Science, v. 163, no. 3864, p. 304–305, 1969.

Physical models for Old Faithful geyser postulated by Geis (1966,1968) and White (1962) are reviewed. It is postulated that after an eruption of short duration, the deep passages of the geyser are left sufficiently hot so that the pressure exerted by cooled water trickling downward is insufficient to terminate boiling completely. After an eruption of long duration the deep rock is left cooled so that deep boiling is temporarily prevented by the pressure of the overlying water remaining in the geyser tube. Eventually the slow upward percolation of hot water from below reheats the overlying water and the rock to the eruption point.—KAF

Frakes, Lawrence A. *See* Landim, Paulo M. B. 06594

00359 **Franklin, George J.** Geologic map of the Nebo quadrangle, Webster and Hopkins Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-777, scale 1:24,000, section, text, 1969.

Coal has been mined extensively in the southwestern section of the Nebo quadrangle where Nos. 9 and 11 beds (Carbondale Formation) have been mined underground and by stripping, and No. 13 (Lisman Formation) by stripping. The quadrangle is cut by two groups of faults that are probably gravity or normal faults. At least 100 holes have been drilled in search for oil and gas; of these 28 have been reported as oil wells, and two as gas wells. With the exception of a single well which reportedly produced from Pennsylvanian rocks, production is reported from rocks of the Mississippian Chester and Meramec Series, with initial production ranging from 3–264 bbl oil per day.—MCM

Frazier, A. W. *See* Lehr, J. R. 06379

06707 **Fremlin, G.; Mindak, H. E.** Lakes, rivers and glaciers—A map commentary [with French, German, and Spanish abs.]: Canadian Cartographer, v. 5, no. 2, p. 133–137, illus., 1968.

The map entitled *Lakes, Rivers and Glaciers* is the first of a new series to supplement the National Atlas of Canada presently in production in the Department of Energy, Mines and Resources, Ottawa. Purpose of this series of separate map sheets is to make available a limited amount of new material in periods between publication of the atlas volumes and to permit flexibility in presentation of atlas material. In this paper, the cartographic problems relating to planning and design of the atlas sheet *Lakes, Rivers and Glaciers*, and techniques of its production are outlined.

The map (scale 1:7,500,000) was derived with minimal generalization from the 1:1,000,000 series of the National Topographic System; within the plan of the atlas it is part of a section devoted to representation of terrain.—*from* Authors' abstract

06599 **Friedman, Gerald M.; Fabricand, Burton P.; Imbimbo, Eugene S.; Brey, Mary E.; Sanders, John E.** Chemical changes in interstitial waters from continental shelf sediments: Jour. Sed. Petrology, v. 38, no. 4, p. 1313–1319, illus., tables, 1968.

The chemical characteristics of interstitial water from cores from the inner and outer shelf off Long Island are compared with the overlying sea water. Cores from the inner shelf consist of clean sands, whereas those from the outer shelf contain a mud fraction. [Various chemical ratios are determined, as are the Eh–pH relations.] The decrease in pH and Eh below the water/sediment interface is attributed to the activity of anaerobic bacteria, and the reasons for other chemical changes are not known but are thought to result from diagenetic changes within the sediment.—*from* Authors' abstract

06389 **Friedman, Jules D.; Williams, Richard S., Jr.** Infrared sensing of active geologic processes, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 787–815, illus., tables, 1968.

A literature review of the use of infrared line-scanning techniques in studies of volcanoes and geothermal fields shows the main contributions of infrared imagery have been the spatial depiction of the relationship between intensity of thermal emission and structure, the recording of time-dependent changes in emission and the documentation of previously unrecorded hydrothermal activity and changes in hydrothermal systems during repose periods. A specific case history of an infrared survey over an active effusive eruption at Surtsey, Iceland, is given.—GWL

00481 **Friedman, M.** Structural analysis of fractures in cores from Saticoy Field, Ventura County, California: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 367–389, illus., tables, 1969.

The orientation and relative positions of subsurface faults are inferred from analysis of macrofractures (joints) and microfractures (unhealed fractures in quartz grains) examined in drill cores. Four macrofracture sets exist along the length of the field, two of these are interpreted to parallel and define the orientations of two reverse faults. Microfractures statistically parallel the macrofractures; their abundance increases towards known faults. Positions and attitudes of predicted faults agree with the known subsurface structure.—*from* Author's abstract

Frondel, Clifford. *See* Ito, Jun. 06449

06574 **Frondel, Clifford.** Meta-aluminite, a new mineral from Temple Mountain, Utah: Am. Mineralogist, v. 53, nos. 5–6, p. 717–721, tables, 1968.

The new species meta-aluminite, $Al_2(SO_4)(OH)_4 \cdot 5H_2O$, occurs abundantly associated with basaluminite and gypsum in veinlets in sandstone at the Fuemrole mine, Temple Mtn., Emery County, Utah. It forms microcrystalline masses of a pure white color and silky luster, is monoclinic, optically biaxial negative, with $\alpha = 1.497$, $\beta = 1.512$,γ about 1.513, 2V small. The extinction angle Y(?) to elongation of minute laths is 43° with Z(?) = b. Specific gravity is 1.85. The four darkest X-ray powder lines are (in A) 4.48 (100), 8.35 (79), 4.36 (67), 6.85 (53). Meta-aluminite is formed when aluminite is heated in air at 55°C. Neither meta-aluminite, aluminite, or basaluminite was observed by Bassett and Goodwin (1949) in study of system Al_2O_3–SO_3H_2O at 25°C.—*from* Author's abstract

06585 **Frondel, Clifford; Ito, Jun.** Synthesis of the scandium analogue of beryl: Am. Mineralogist, v. 53, nos. 5–6, p. 943–953, illus., tables, 1968.

The scandium analog of beryl has been synthesized by hydrothermal crystallization of precipitated gels of stoichiometric composition at 450° to 750°C, 2 kbars pressure, and run times of 20 to 48 hours. Solid solutions with substitution of Sc by R^{3+} ions, where R^{3+} is Fe^{3+}, Cr^{3+}, V^{3+}, Mn^{3+}, or Ga, also have been synthesized, but it does not extend to the Sc-free end composition. The Sc-beryl has a = 9.56

A, c = 9.16 A. The Sc and (Sc,R^{3+}) beryls are characterized by very large increase in *a* and a small decrease in *c*, decrease in cell volume, and higher birefringence caused by relatively large increase in ω, as compared to ordinary Al-beryl. Indices of refraction increase with increasing substitution of Sc by R^{3+} ions.—MEM

06773 **Frondel, Clifford; Ito, Jun; Montgomery, Arthur.** Scandium content of some aluminum phosphates: Am. Mineralogist, v. 53, nos. 7–8, p. 1223–1231, illus., tables, 1968.

Scandium is a minor constituent of aluminum phosphate minerals in the variscite deposit at Fairfield, Utah. Main minerals in the deposit, variscite and crandallite, contain from 0.01 to 0.80 weight percent Sc_2O_3. Comparable amounts are present in millisite, wardite, 'deltaite', goyazite and other less common species. A scandium phosphate, sterrettite (kolbeckite), also occurs. The minerals have been formed under near-surface conditions by phosphatic ground waters probably derived by weathering of phosphorites of the overlying Phosphoria formation from which the Sc and the chief minor elements, Sr, Y and V, may also have been derived. Variscite from other deposits in Utah and Nevada also contains significant amounts of Sc. Variscite, wavellite, crandallite, vashegyite and other Al phosphates from localities outside this region, however, contain Sc only in traces or below recognition level.—*from* Authors' abstract

Frondel, Clifford. *See* Ito, Jun. 06783

06549 **Frost, Jack Glenn.** Algal banks of the Dennis Limestone (Pennsylvanian) of eastern Kansas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2086B–2087B, 1968.

06361 **Fuchs, Louis H.** X-ray crystallographic evidence for the meteoritic occurrence of nepheline: Earth and Planetary Sci. Letters, v. 5, no. 3, p. 187–190, table, 1968.

Nepheline has been identified by X-ray powder patterns obtained from several unequilibrated chondrites. It commonly occurs in chondrules as optically unresolvable crystals in lavender-colored glass interstitial to bands of olivine. The presence of nepheline indicates that some chondrules are undersaturated in silica, relative to albite and olivine, a condition which probably does not persist in the most equilibrated chondrites.—Author's abstract

06469 **Gabert, Gordon M.** Groundwater-level fluctuations in Alberta, Canada, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 190–195, illus., table, reprinted 1968; originally published 1965.

This paper is reprinted with minor changes from Canadian Jour. Earth Sci., v. 2, no. 2, p. 131–139, 1965.—MCM

06747 **Gaines, Richard V.** Poughite, a new tellurite mineral from Mexico and Honduras: Am. Mineralogist, v. 53, nos. 7–8, p. 1075–1080, tables, 1968.

Poughite, a new hydrous basic ferric tellurite, has been found at the Moctezuma Mine, Sonora. It is identical with an unnamed mineral from Honduras, partially described in 1944 by Frondel and Pough. The mineral is yellow to greenish yellow in color, orthorhombic with a = 9.66, b = 14.20, c = 7.86A, Z = 4, with a habit and cleavage similar to barite. Hardness is 2 1/2; specific gravity is 3.758 (meas.), 3.755 (calc.). Optically, biaxial negative, 2V = 15°–20°, $\alpha = 1.72 \pm 0.01$ (colorless,*b*), $\beta = 1.985 \pm 0.01$ (pale greenish yellow, *a*), $\gamma = 1.990 \pm 0.01$ (pale yellow). Strongest lines of the X-ray diffraction pattern are = 7.10 (10)(020); 5.74 (10)(120); 3.239 (7)(122); 3.564 (6)(221).—MEM

06369 **Galle, O. Karmie; Angino, Ernest E.** Trace elemental analysis of fresh water by atomic absorption, *in* Short papers on research in 1967: Kansas Geol. Survey Bull. 191, pt. 1, p. 3–7, illus., table, 1968.

Cobalt, iron, lithium, manganese, nickel, strontium, zinc, and silicon were determined in water from several streams and ponds of the Kansas River basin. These can be determined from the same concentrated solution by evaporating 500

ml of filtered water down to 10 ml. This solution is then brought to 50 ml by distilled and deionized water. The coefficient of variation for each element was: Co 6 percent at 0.08 ppm, Fe 5 percent at 0.06, Li 10 percent at 0.01, Mn 2.5 percent at 0.02, and Sr 7 percent at 0.08 ppm. Even though these variations could be improved, they are adequate for this study.—*from* Authors' abstract

Galloni, E. E. *See* deAbeledo, M. E. J. 06448

Garnier, G. *See* Aitcin, P. C. 06777

00497 **Gartner, Stefan, Jr.** Two new calcareous nannofossils from the Gulf Coast Eocene: Micropaleontology, v. 15, no. 1, p. 31–34, illus., 1969.

A rich assemblage of calcareous nannofossils from the type Shubuta Clay, Upper Eocene of Mississippi, includes two previously undescribed species. *Bramletteius serraculoides* and *Hayella situliformis*, each of which is here described as the type of a new genus.—Author's abstract

00444 **Garwin, Leo.** Helium—An unnatural natural gas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 213, 1969.

06519 **Gaymard, R.; Poupon, A.** Response of neutron and formation density logs in hydrocarbon bearing formations: Log Analyst, v. 9, no. 5, p. 3–12, illus., tables, 1968.

It is usually assumed that, in oil bearing formations, the Neutron and Formation Density logs are not significantly affected by the residual oil in the invaded zone and that they respond as if the volume investigated was entirely filled with mud filtrate. However when porosities are fairly high, the effect of this residual oil is not always negligible, particularly if the oil is light. Computations have been made to evaluate this effect. Formulae have been developed for clean oil or gas-bearing formations. These formulae permit a more accurate evaluation of the porosity. Some of the formulae may also have application in the cases of shaly formations and of complex lithologies.—Authors' abstract

00589 **Gealy, Elizabeth L.; Davies, T. A.** The Deep Sea Drilling Project: Geotimes, v. 14, no. 2, p. 10–12, illus., table, 1969.

The goal of the deep-sea sediment coring project is to help determine age and development of ocean basins by drilling deep holes in the floor. Cores are collected and in-hole measurements of physical properties are made. Planned cruises are: Orange, Tex. to New York; New York to Dakar, Senegal; Dakar to Rio de Janeiro; Rio de Janeiro to Panama; Panama to Hawaii; Hawaii to Guam, southern route; Guam to Hawaii, northern route; Hawaii to Tahiti; and Tahiti across the East Pacific Rise. Seismic and magnetometer surveys will be carried out also. Leg 1 has been completed and a table of data on the holes drilled is included. Methods of core study are given. Caprock overlain by Miocene sediments was recovered on a Sigsbee Knoll, and Cretaceous sediments were recovered east of San Salvador.—ESL

Geissman, Theodore A. *See* Murdoch, Joseph. 06455

00548 **Geller, S.** Alternative explanation of the garnet occurrence in a meteorite [Discussion of paper by B. Mason, J. Nelen, J. S. White, Jr., 1968]: Science, v. 163, no. 3869, p. 829–830, table, 1969.

The composition reported by Mason, Nelen, and White (ibid., v. 160, no. 3823, p. 66–67, 1968) for the "garnet" found in the Coorara meteorite is very unlikely for a garnet with the given lattice constant. To account for the low lattice constant requires the presence of Si^{4+} ions in octahedral sites if no other cations than Mg^{2+}, Fe^{2+}, Fe^{3+}, and Si^{4+} are present.—DBV

06403 **Gensurowsky, Walter.** Applications of economic analysis to problems of data collection by remote sensing techniques, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 299–305, table, 1968.

The application of economic analysis to problems of data collection by remote sensing techniques can result in solutions that will assist a decision maker. Elements of risk and of multiple alternative can be considered within the framework of a linear programming model. Information on input alternatives, their costs, interrelationships, and probabilities of success is necessary. A linear programming model formulated to minimize total cost is given.—GWL

Gerard, J. T. *See* Holland, William J. 06741

06401 **Gerlach, Arch C.** Advances in geographic and thematic mapping applications of remote sensor data, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 191–196, 1968.

The development of a variety of remote sensing instruments for use in aircraft and spacecraft has removed significant barriers to geographic and cartographic research, expanded tremendously the horizons for participation in the analysis and applications of new forms and great volumes of data, and stimulated a review of traditional objectives and methodologies. The hardware and instrumentation requirements for obtaining useful data from orbital heights are described in terms of current objectives, and results of research contracts financed by NASA through the Geological Survey are summarized in terms of data selection, signature identification, sensor calibration, and the development of information systems and print-out techniques. The potentials and economies of international cooperation in Earth study from orbital platforms are recognized, and some of the current possibilities are mentioned.—Author's abstract

Gibbs, G. V. *See* Birle, J. D. 06460

06355 **Gilbert, C. M.; Christensen, M. N.; Al-Rawi, Yehya; Lajoie, K. R.** Structural and volcanic history of Mono Basin, California-Nevada, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 275–329, illus., table, geol. map, 1968.

Mono Basin is a post-Miocene, northeast-trending structural depression. A negative gravity anomaly of 50 mgal centers under the Lake in the western portion of the basin, which is surrounded by Pliocene, Pleistocene, and Holocene volcanic rocks. K-Ar ages and distribution and relation of young volcanic rocks show several separate volcanic episodes and that volcanism was synchronous only during the period about 2–4 m.y. ago. Mono Basin is not a caldera-like collapse structure due to eruption of magma; volcanism and deformation have been synchronous but their relation is incidental. Deformation has been continuous during the last 3–4 m.y. Rates of differential vertical movements in marginal regions were 1 to 2 feet per thousand years and between margins and center of the basin, 2–4 feet per thousand years.—*from* Authors' abstract

Gilbert, J. Freeman. *See* Helmberger, Donald V. 06637

00384 **Gill, Mohammad Akram.** Flatness index of non-spherical sedimentary particles: Jour. Geology, v. 77, no. 1, p. 120–124, tables, 1969.

The flatness index, by definition, is the reciprocal of the true sphericity. This index for a sedimentary particle can be evaluated with a reasonable degree of accuracy from the volume and intercepts of the particle, and the surface area need not be measured.—*from* Author's abstract

00411 **Gillerman, Elliot.** The Roselle lineament of southeast Missouri [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 11–12, 1969.

06515 **Givens, W. W.; Caldwell, R. L.; Mills, W. R., Jr.** Cyclic activation logging: Log Analyst, v. 9, no. 3, p. 18–21, illus., 1968.

Cyclic activation analysis shows considerable promise as a logging method for elemental identification in that the enhancement of very short-lived activities should make possible continuous rather than point-by-point logs. A basic understanding of cyclic activation and of criteria for evaluating the several possible cyclic activation

logs is essential for proper application. The importance of the waiting period t_w under borehole conditions, and the interference due to natural gamma rays are discussed as examples.—VSN

06678 **Gleeson, C. F.** (compiler). Copper content of stream and spring sediments, Keno Hill area, Yukon Territory: Canada Geol. Survey Prelim. Ser. Map 50–1965, scale 1:126,720, text, 1968.

The Keno Hill area is underlain by a series of Precambrian to Mesozoic metasediments, mainly quartzites, phyllites, slates, chlorite, sericite and graphite schists, grits and minor limestone; these are interlayered with mafic igneous sills and lenses now altered to greenstones. The area has undergone several stages of glaciation and permafrost is present everywhere. Samples of stream and spring sediments were analyzed for copper by fusion with potassium bisulfate followed by colorimetric determination with dithizone. Statistical studies have not been completed, but a cumulative distribution curve indicates that copper is distributed lognormally; values range from less than 4 to 500 ppm. The majority of high copper values are in areas underlain by massive quartzite and phyllites with lenses and sills of greenstone.—MCM

06679 **Gleeson, C. F.** (compiler). Cobalt content of stream and spring sediments, Keno Hill area, Yukon Territory: Canada Geol. Survey Prelim. Ser. Map 54–1965, scale 1:126,720, text, 1968.

The general geology of the Keno Hill area is covered also on Map 50–1965 (Gleeson, 1968). Cobalt was analyzed spectrographically by the total energy D.C. arc semiquantitative method using a Jarrell Ash optical spectrograph with a 1.5 m grating. Final results have not been completed, but the cumulative distribution curve indicates two distributions, both lognormal; values ranged from less than 7 to 1,000 ppm. The majority of the high cobalt values are coincident with high nickel values (Map 53–1965, 1967) and are thought to be related to ultramafic greenstones. There is no apparent correlation between the cobalt in the stream and spring sediments and known silver veins of the area.—MCM

06680 **Gleeson, C. F.** (compiler). Manganese content of stream and spring sediments, Keno Hill area, Yukon Territory: Canada Geol. Survey Prelim. Ser. Map 55–1965, scale 1:126,720, text, 1968.

The general geology of the Keno Hill area is covered also on Map 50–1965 (Gleeson, 1968). Manganese was analyzed spectrographically by the total energy D.C. arc semiquantitative method using a Jarrell Ash optical spectrograph with a 1.5 m grating. A tentative cumulative distribution curve, indicating manganese values from 50 to greater than 10,000 ppm, has a distinct break at 1,500 ppm, suggesting two distributions, both probably lognormal. Areas particularly high in manganese include the drainage systems of Mt. Haldane, Galena Hill, Keno Hill, Davidson Range, northeast sector of Gustavus Range, north of McQuesten Lake, and Eagle and Sluice Creeks in the northwest corner of the area.—MCM

06681 **Gleeson, C. F.** (compiler). Boron content of stream and spring sediments, Keno Hill area, Yukon Territory: Canada Geol. Survey Prelim. Ser. Map 56–1965, scale 1:126,720, text, 1968.

The general geology of the Keno Hill area is covered also on Map 50–1965 (Gleeson, 1968). Boron was analyzed spectrographically by the total energy D.C. arc semiquantitative method using a Jarrell Ash optical spectograph with a 1.5 m grating. A tentative cumulative distribution curve indicates values for boron range from less than 7 to 1,100 ppm. The two distributions shown by a break at about 150 ppm suggests that data in each segment may be lognormal. High concentrations of boron, found in stream sediments from Dublin Gulch–Secret Creek area and at Mt. Haldane, are probably related to tourmaline derived from contact metamorphic rocks in the vicinity of granite intrusions.—MCM

06608 **Godden, C. A.; Pelletier, B. R.** Submersible electric rock-coring drill, A. O. L., Bedford Institute, Dartmouth, N. S.: Maritime Sediments, v. 4, no. 2, p. 77, illus., 1968.

An electro-mechanical system is described that comprises a vertical mast assembly mounted into a tripod base, and features an automatic-penetration and core retrieval drive. A pull down and retractable endless chain on the mast carries a self-contained rotary drive system, providing power for the attached core barrel. In a trial test made in the Bedford Basin, the drill was lowered in 30 feet of water and penetrated two feet of bottom mud and 16 inches of bedrock (Goldenville quartzite). Full recovery was obtained in 12 minutes of drilling at 350 rpm. An underwater television system provided visual monitoring; a tachometer and depth indicator on drill stem provided visual inspection of the rate of penetration.—GDC

00394 **Goebel, Edwin D.; Waugh, Truman C.; Angino, Ernest E.** Metallic sulfide mineralization in some mid-continent Paleozoic cores [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 12, 1969.

06373 **Goebel, Edwin D.; Thompson, Thomas L.; Waugh, Truman C.; Mueller, Leslie C.** Mississippian conodonts from the Tri-State district, Kansas, Missouri, and Oklahoma, *in* Short papers on research in 1967: Kansas Geol. Survey Bull. 191, pt. 1, p. 21-25, illus., table, 1968.

Conodonts were recovered as acetic acid residues from carbonate rock samples from the Tri-State lead-zinc district ore bodies of Kansas, Missouri, and Oklahoma. The specimens are unaltered. The fauna belongs to the *Gnathodus texanus-Taphrognathus* Zone (late Osagean).—Authors' abstract

06721 **Goldman, Harold B.** Sand and gravel in California, an inventory of deposits—Pt. C, Southern California: California Div. Mines and Geology Bull. 180-C, 56 p., illus., table, 1968.

Reconnaissance of sand and gravel deposits in 10 southern counties included those worked commercially and those undeveloped but of potential economic interest. Stream deposits, ancient beach deposits, and old geologic formations including sandstone and conglomerates are the principal sources; the bulk of sand and gravel occurs in the stream beds, floodplains, terraces and alluvial fans of the major streams. Production from these counties in 1966 was approximately 66 million tons of sand and gravel for use as concrete or bituminous aggregate and road base. Data on the individual deposits, including that from laboratory tests, are presented in tabulation. Locations and extent of the deposits are shown on accompanying map (in pocket).—*from* Author's abstract

06481 **Goldthwait, Richard P.** Hydrologic hazards from earthquakes, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 405-414, 1968.

In this summary chapter the conditions conducive to hydrologic effects of the earthquake waves are listed. Immediate hazards to avoid are snowslides and avalanches, landslides of rock or debris, floods, seiching, and ground-water ejections. After-effects hazardous to equipment are: well-water-level changes, stream-flow changes, and glacier-regimen changes. Lessons to be learned from the immediate hazards are principally those of zoning; from the after-effects, the lessons involve what hydrologic damage to expect and steps that may be required to relieve the situations. The conclusions of the Panel on Hydrology are summarized.—MCM

Goodell, H. G. *See* Earley, Charles F. 06689

Goodell, H. Grant. *See* Schnable, Jon E. 06659

Goodson, J. L. *See* Brown, L. F. 00415

06573 **Gordon, Mackenzie, Jr.** An early *Reticuloceras* Zone fauna from the Hale Formation in northwestern Arkansas: U.S. Geol. Survey Prof. Paper 613-A, 21 p., illus., 1968.

Nine species of ammonoids are described and illustrated from the upper part of the Cane Hill Member and the basal Part of the Prairie Grove Member of the Hale Formation, Washington County, Ark. These comprise the earliest known

cephalopod fauna from the Lower Pennsylvanian (Morrow) rocks of North America. The stratigraphic interval in which all nine species occur and to which five of them seem to be restricted, constitutes the *Reticuloceras tiro* Zone. This zone can be correlated approximately with the lowest subdivision of the lower *Reticuloceras* Zone (R_1a) of northwestern Europe including the British Isles.—MG

00388 **Gordon, Robert B.** A note on the weathering of serpentinite found in southeastern Pennsylvania: Pennsylvania Acad. Sci. Newsletter, v. 27, no. 1, p. 1, 1969.

In soils of the Chrome Series in Chester and Delaware Counties, some honey combed or pitted specimens coated with limonite are found; on fresh surfaces, pockets of drusy iron-stained quartz may be disclosed. These specimens could easily be mistaken for achondrites, but their location in the upper part of the soil over serpentinite deposits indicates that they are alteration products, passing through stages of chelation that are little understood. Other rust-colored objects the size and shape of cannonballs are scattered in the same area.—ESL

00438 **Gose, Wulf A.** Mossbauer studies on a large griphite crystal [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 209, 1969.

Gottardi, G. *See* Sanero, E. 06752

Gottfried, David. *See* Tilling, R. I. 00561

06672 **Goudarzi, Gus H.; Smith, Avery E.** Geologic map of the Pleasant Ridge quadrangle, Ohio and Daviess Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-766, scale 1:24,000, section, text, 1968.

Mineral resources of the Pleasant Ridge quadrangle are oil, natural gas, and coal. Oil and gas have been produced principally from the basal Pennsylvanian Caseyville Formation at depths of 500–700 feet, and from the Late Mississippian Tar Springs Sandstone at 600–900 feet. Coal was mined underground from several beds and small quantities were recovered by strip mining as late as 1966.—MCM

06792 **Grande Lopez, Raul.** Morfología y génesis de suelos yesíferos de Matehuala, S. L. P., Pt. 2: Geología y Metalurgía, v. 3, no. 23, p. 5–71, illus., tables, 1968.

This is the conclusion (*see* ibid., no. 22, p. 5–16, 1967) of a study of morphology, genesis, mineralogy, and geochemistry of gypsiferous and associated soils (aridisols) in the area of Matehuala, San Luis Potosí, an alluvial plain in the Mexican Highland. Five representative soil profiles are analyzed and compared: gypsiferous, calco-gypsiferous, salino-calcareous, alluvial with salts, and alluvial without salts. Aridity, high temperatures, topography, and wind action are principal factors in the incomplete development of soil profiles. The gypsiferous soils, which overlie gypsum strata, and the adjacent calco-gypsiferous soils over limestone show secondary enrichment of gypsum in the B and A_1 horizons. Dolines, a karst feature, originate by underground solution of stratified gypsum and gradual subsidence of the overburden.—VMJ

Granquist, W. T. *See* Wright, Alan C. 06785

Greeley, R. *See* Oberbeck, V. R. 00544

Greenland, L. Paul. *See* Tilling, R. I. 00561

06550 **Greenwood, William Rucker.** Genesis and history of the augen gneiss of Red River, Idaho County, Idaho [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2087B, 1968.

00579 **Gresens, Randall L.** Calculation of rational norms [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 62–63, 1969.

Griffiths, J. C. *See* Ondrick, C. W. 00627

00543 **Grim, Muriel S.; Bennett, Lee C., Jr.** Shallow sub-bottom geology of the Washington shelf off Grays Harbor [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 63–64, 1969.

06575 **Grim, Ralph E.** Clay mineralogy (2d edition): New York and London, McGraw-Hill Book Co., 596 p., illus., tables, 1968; originally published 1953.

The organization of this volume is essentially the same as the first edition but the important contributions made regarding atomic structure, reaction of clay minerals and organic compounds, solid-state reactions, and compositions of ancient sediments, soils, and other materials are included to make more acceptable some tentative and preliminary conclusions outlined in the first edition. Chapter headings are: introduction; concepts of the composition, classification and nomenclature, and structure of clay minerals; diffraction data; shape and size—electron microscopy; ion exchange and sorption; clay-water system; dehydration, rehydration, and changes taking place on heating; clay-mineral—organic reactions; optical properties; miscellaneous properties; origin and occurrence of clay minerals. An appendix contains chemical analyses.—MCM

06723 **Grimmer, John C.** Stratigraphy of the Middle Devonian shales of southern Illinois: Illinois Acad. Sci. Trans., v. 61, no. 4, p. 407–415, illus., table, 1968.

Study of fossils from the Middle Devonian shales of southern Illinois has made possible the differentiation of these beds into two units. The first unit, the Misenheimer Shale, is assigned to the Lingle Limestone as its basal member; the second unit, strata below the Misenheimer and above the Grand Tower Limestone in northern Union County, is tentatively referred to the St. Laurent Limestone.—Author's abstract

00563 **Grover, John E.; Orville, Philip M.** The partitioning of cations between coexisting single- and multi-site phases with application to the assemblages orthopyroxene-clinopyroxene and orthopyroxene-olivine: Geochim. et Cosmochim. Acta, v. 33, no. 2, p. 205–226, illus., 1969.

A partitioning model is presented which provides a generalized method for treating certain multiple-site exchange equilibria. For example, it may explain the Fe-Mg distributions observed in the coexisting assemblages orthopyroxene-clinopyroxene and orthopyroxene-olivine. In addition, it provides a way of determining standard state free energies of exchange (1) between coexisting single- and double-site phases and (2) between cation sites within a double-site phase, and (3), with modifications, between three coexisting single-site phases.—DBV

Gude, Arthur J., 3d. *See* Raup, Omer B. 06787

06749 **Guidotti, C. V.** Prograde muscovite pseudomorphs after staurolite in the Rangeley-Oquossoc areas, Maine: Am. Mineralogist, v. 53, nos. 7–8, p. 1368–1376, illus., 1968.

Pseudomorphous aggregates of muscovite after staurolite are characteristic of the lower sillimanite- to upper sillimanite-grade metapelites in parts of N.W. Maine. Traditional interpretations for these pseudomorphs would include retrograde metamorphism or K-metasomatism. However, mineralogic, petrographic, and field evidence clearly shows that the pseudomorphs have formed as a byproduct of a simple prograde metamorphic event. The exact mechanism by which the pseudomorphs develop remains unclear but seems to involve the dissolution of staurolite and concomitant replacement by muscovite.—Author's abstract

06442 **Guidotti, Charles V.** On the relative scarcity of paragonite: Am. Mineralogist, v. 53, nos. 5–6, p. 963–974, illus., 1968.

Consideration of low to medium-grade paragonite-bearing rocks suggests that the presence of paragonite is related to relative enrichment in Al_2O_3 and/or $NaAlO_2$. It appears that rocks with insufficient Al_2O_3 to plot above the garnet-chlorite join on an AKFm projection will not develop paragonite. Reactions with increasing metamorphic grade bring in the assemblage alumino-silicate + biotite. Paragonite

can occur in kyanite + biotite-bearing assemblages. It is postulated that the pT curve for the breakdown of paragonite and those for the reactions producing alumino-silicate + biotite must cross so that paragonite is unstable before the assemblage andalusite (or sillimanite) + biotite becomes stable.—*from* Author's abstract

06616 **Gunn, Christopher B.** Field concentration of heavy minerals: Jour. Sed. Petrology, v. 38, no. 4, p. 1362, illus., 1968.

It is quite feasible to concentrate material for heavy mineral studies in the field. This saves much labor and extends the scope of the geologist in the field.—Author's abstract

06603 **Gutstadt, Allan M.** Petrology and depositional environments of the Beck Spring Dolomite (Precambrian), Kingston Range, California: Jour. Sed. Petrology, v. 38, no. 4, p. 1280–1289, illus., 1968.

The Beck Spring dolomite is divided into three informal members: lower laminated—150–200 m of alternating laminae of pelletal and mosaic dolomite; middle oolitic—100–150 m of mosaic dolomite with oolite, pisolite, and grapestone; and upper cherty—100–150 m, similar to the oolitic except that it includes stromatolites and has been partially silicified and dolomitized. The lower laminated member was deposited in a supratidal environment, and the middle and upper members were deposited in shallow, agitated waters of a subtidal environment. The characteristics of the Beck Spring Dolomite are similar to those of sediments now being deposited in parts of the Bahama Banks.—*from* Author's abstract

Habib, D. *See* Needham, H. D. 00383

00395 **Habib, Daniel.** Carboniferous palynostratigraphy—Scope and limitation [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 12–13, 1969.

00500 **Habib, Daniel.** Middle Cretaceous palynomorphs in a deep-sea core from the Seismic Reflector Horizon A outcrop area: Micropaleontology, v. 15, no. 1, p. 85–101, illus., tables, 1969.

The assemblage of palynomorphs in the bottom of a deep-sea core collected from the outcrop area of Seismic Reflector Horizon A northeast of Cat Island in the Bahamas indicates a Middle Cretaceous age (Albian or early Cenomanian). Fifty-three species of spores, pollen, and marine microplankton (acritarchs, hystrichosphaerids and dinoflagellates) are listed. Twelve species and one acritarch genus, *Prismatocystis*, are described as new. The assemblage dates the core amongst the oldest yet recovered from deep-sea basins.—Author's abstract

06490 **Hackman, Robert J.** Interpretation of Alaskan postearthquake photographs, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 40–46, illus., reprinted 1968; originally published 1965.

This paper is reprinted with minor changes from Photogramm. Eng., v. 31, no. 4, p. 604–610, 1965.—MCM

Halderman, Allan D. *See* Davis, Stanley N. 00491

00608 **Hales, A. L.; Bloch, S.** Upper mantle structure—Are the low velocity layers thin?: Nature, v. 221, no. 5184, p. 930–933, illus., 1969.

Body-wave traveltimes and surface-wave dispersion tend to favor the hypothesis that the low-velocity layers are relatively thin zones of high velocity contrast. The effects of replacing a thick, low-contrast, low-velocity layer by a thin near-liquid layer on the periods of the free oscillations and on the velocities for very long period surface waves have yet to be studied.—DBV

Hallinger, Donald E. *See* Haun, John D. 00436

Haneman, F. *See* Ewen, H. I. 06394

06772 **Hanor, Jeffrey S.** Frequency distribution of compositions in the barite–celestite series: Am. Mineralogist, v. 53, nos. 7–8, p. 1215–1222, illus., 1968.

Complete solid solution exists between $BaSO_4$ and $SrSO_4$, but intermediate compositions are rare in nature. During precipitation from aqueous solution, $(Ba,Sr)SO_4$ does not reequilibrate in response to changes in the composition of the parent liquid. Frequency distributions of compositions calculated for precipitation models that assume this inert behavior, complete solid solution, and a wide range of initial liquid compositions agree closely with the observed frequency distribution of barite–celestite compositions. Inert behavior results in a geochemical separation of Ba and Sr and can account for the paucity of intermediate sulfate compositions.—Author's abstract

Haramura, H. *See* Forbes, Robert B. 00614

06675 **Hardie, Lawrence A.** The origin of the Recent nonmarine evaporite deposit of Saline Valley, Inyo County, California: Geochim. et Cosmochim. Acta, v. 32, no. 12, p. 1270–1301, illus., tables, 1968.

The mineralogy and hydrochemistry of the Recent evaporite deposit in the Saline Valley playa has been studied. The playa is fed by ground water only. The ground water is sodium–calcium sulfate–bicarbonate water, while playa brines are sodium sulfate–chloride waters which progressively increase in total iron concentration from the margin toward the playa center. Two initial steps in the development of playa brines are: (1) calcite precipitation within alluvial fans causing a drastic decrease in Ca^{+2} and HCO_3^- proportions in the waters reaching the playa, and (2) precipitation of gypsum at the playa edge, which controls the initial SO_4^{-2} concentrations of the brines.—*from* Author's abstract

06370 **Hardy, Ronald G.; Huh, John M.; Bauleke, Maynard P.** Kansas raw materials for the manufacture of reflective glass beads, *in* Short papers on research in 1967: Kansas Geol. Survey Bull. 191, pt. 1, p. 9–11, illus., table, 1968.

Cheyenne Sandstone from Comanche County, dune sand from near Liberal, Kansas, and caliche or chalk from the Fort Hays Limestone Member of the Niobrara Chalk were used in glass compositions to make reflective glass beads. Both sources of sand were acid-leached to reduce their iron content. Index of refraction and light reflectivity of the experimental glass beads produced were of the same value as those of currently manufactured commercial products.—Authors' abstract

Hardy, Ronald G. *See* Huh, John M. 06372

00506 **Hare, Ben D.** Petrology of fluviatile sandstones, Thurman Formation, Coal County, Oklahoma [abs.]: Oklahoma Geology Notes, v. 29, no. 1, p. 19–20, 1969.

06708 **Hargrove, Gene.** Relation of a chert zone to development of Devils Icebox, Boone County, Missouri: Missouri Speleology, v. 10, no. 1, p. 15–21, illus., 1968.

A resistant chert zone, transition between lower and upper Burlington Limestone (Mississippian), greatly influences development of Devils Icebox, a large cave in Boone County, Missouri. This zone causes offsetting of domepits with respect to surface sinks, determines the height of domepits, and forms several distinctive speleogenic features of the cave. The chert zone appears in the tops of domepits in areas nearest the cave entrance, and is transected by major passages in remote areas of the cave due to headward gradient of the cave passages.—Author's abstract

06648 **Harkrider, David G.; Flinn, Edward A.** Comparison of theoretical Rayleigh waves generated by atmospheric explosions over an oceanic and a continental model [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 7–8, 1968.

06533 **Harmon, Kathryn Parker.** Late Pleistocene forest succession in northern New Jersey [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 1942B, 1968.

00612 **Harms, J. C.** Hydraulic significance of some sand ripples: Geol. Soc. America Bull., v. 80, no. 3, p. 363–395, illus., 1969.

Ripples commonly formed on sand beds by moving water can be interpreted in terms of their hydraulic environments of formation more completely than before. Results of flume studies have defined many of the hydraulic variables that affect ripple forms and dimensions. Critical parameters include orientation and continuity of crests, ripple spacing and height, ripple index, angularity or roundness and slope of ripple profiles, and grain-size distribution. Results of flume studies were applied to a variety of ripples in rock sequences resulting in some reinterpretation of environments of deposition reported earlier. Techniques do not apply closely to silt-size sediments.—JHF

00540 **Hart, S. R.; Davis, G. L.** Zircon U–Pb and whole-rock Rb–Sr ages and early crustal development near Rainy Lake, Ontario: Geol. Soc. America Bull., v. 80, no. 4, p. 595–616, illus., tables, 1969.

Early Precambrian rocks are metasediments and paragneisses (Coutchiching) overlain conformably by metavolcanics (Keewatin) and intruded by Laurentian igneous rocks. Eight of ten zircon samples from these units lie within experimental error (± 30 m.y.) of a 2,750-m.y. Concordia chord. We conclude that the zircon ages are primary. It is probable that detrital zircons were derived from contemporaneous volcanics within the geosyncline. There is little recorded time difference (<50 m.y.) between the volcanic-sedimentary pile and intrusion of Laurentian igneous rocks. The Rb–Sr isochron for the volcanics gives an age of 2,770 m.y.; the Coutchiching isochron age is 2,690 m.y. Both are in agreement with the zircon age.—*from* Authors' abstract

00591 **Hatton, G. E.** Memorial, Garold Louis Knight (1894–1968): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 185–186, portrait, 1969.

00436 **Haun, John D.; Barlow, James A., Jr.; Hallinger, Donald E.** Gas potential of Rocky Mountain region [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 211, 1969.

Havey, Robert W. *See* Saunders, John M. 06717

06356 **Hay, R. L.; Iijima, A.** Nature and origin of palagonite tuffs of the Honolulu Group on Oahu, Hawaii, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 331–376, illus., tables, 1968.

Tephra deposits (alkali basalt to melilite nephelinite) of the Honolulu Group on Oahu are middle to late Pleistocene. Some deposits are fresh, but most are zeolitic palagonite tuff. Pyroclastic deposits are generally zoned from clayey soil 3–8 feet thick, down into relatively fresh tuff from 15–40 feet thick, underlain by palagonite tuff 60 or more feet thick. The amount of authigenic minerals in tuffs is generally proportional to the amount of palagonite and indicates that minerals are related to the palagonitization process. Reaction of sideromelane with cold ground water accounts for the vertical zoning from surface tuffs down into palagonite. The sharp interface between unaltered sideromelane and palagonite suggests that palagonite formed by a microsolution–precipitation mechanism.—*from* Authors' abstract

Hay, Richard L. *See* Coats, Robert R. 06498

00507 **Hayes, Curtis J.** Landslides on Oklahoma's highways [abs.]: Oklahoma Geology Notes, v. 29, no. 1, p. 20, 1969.

00559 **Heath, G. Ross.** Carbonate sedimentation in the abyssal equatorial Pacific during the past 50 million years: Geol. Soc. America Bull., v. 80, no. 4, p. 689–694, illus., 1969.

Early and middle Tertiary deep-sea carbonates from the equatorial Pacific differ in texture and depth distribution from younger deposits. Pre-Pliocene carbonates are well sorted; they are dominated by nannoplankton, and have median grain diameters close to 5 microns. In contrast, Pliocene and Quaternary deposits are

poorly sorted. They are frequently rich in tests of Foraminifera, and have median diameters ranging from about 1 to more than 60 microns. The calcite compensation level, now close to 4700 m, has risen from a depth of more than 5200 m since the Oligocene. The rise reflects, in part, the effect of decreasing bottom water temperatures on solubility of calcium carbonate.—*from* Author's abstract

06368 **Heath, Ralph C.** Work of the U.S. Geological Survey on Hudson River estuary, *in* Hudson River ecology—Symposium, 1966, Tuxedo, N.Y.: [Albany] Hudson River Valley Comm. New York, p. 131–134, illus. [1968?].

The movement of the water in the estuary, the movement of the salt–water front, and the determination of chemical quality and sediment content of the water are the projects being undertaken.—HRC

Heezen, B. C. *See* Needham, H. D. 00383

00460 **Hegna, Earl T.** South Coyote Creek field, Weston County, Wyoming [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 218, 1969.

06518 **Helander, Donald P.** Formulation [!Formation] evaluation education at the University of Tulsa: Log Analyst, v. 9, no. 4, p. 18–20, illus., 1968.

This article summarizes course work, research in progress, and problems involved in the teaching of formation evaluation at the University of Tulsa.—VSN

00569 **Helley, E. J.** Field measurement of the initiation of large bed particle motion in Blue Creek, California [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 57, 1969.

06637 **Helmberger, Donald V.; Gilbert, J. Freeman.** Application of generalized ray theory to spherical layers [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 18, 1968.

Hem, J. D. S*See* Roberson, C. E. 06683

Henage, Lyle F. *See* Best, Myron G. 06576

00473 **Henderson, John R.** Tectonic significance of minor structures in Conococheague Formation near Lancaster, Pennsylvania: Am. Jour. Sci., v. 267, no. 2, p. 166–180, illus., 1969.

Conococheague limestone and dolomite beds form small scale noncylindrical recumbent folds with homoaxial mineral lineations (L′) on a semipenetrative axial plane foliation (S_f). Large scale recumbent folds are noncylindrical and nonplanar, but mineral lineations remain homoaxial on the scale of the area mapped. Analysis of a deformed oolite bed indicates that the rocks have undergone three–dimensional strain involving constriction. S_f and L′ mark the principal flattening plane and elongation direction; small folds may have originated by simultaneous buckling in two principal strain directions.—*from* Author's abstract

Henniger, Bernard R. *See* Martin, Wayne D. 00511

00396 **Hepner, Beverly J.; Shaffer, Bernard L.** Effects of ash–falls on Cretaceous floras—Palynology of rocks associated with bentonites [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South–Central Sec., p. 13–14, 1969.

06516 **Heseldin, G. M.** The use of error ratio in least square fitting of data: Log Analyst, v. 9, no. 3, p. 22–25, illus., 1968.

The method of "constant error ratio least square fit" is described as a superior method of correlating data for cases in which the ratio of the absolute errors in both variables can be determined realistically. It is pertinent for application to comparison of laboratory analyses on identical samples, sonic transit time versus porosity relations in carbonates, and extrapolating pressure build–up analyses.—VSN

06774 **Heydemann, Annerose; Brindley, G. W.** Selective absorption of n-alkyl alcohol-bromide mixtures by montmorillonites (clay-organic studies XIV): Am. Mineralogist, v. 53, nos. 7-8, p. 1232-1243, illus., table, 1968.

Li-, Na-, Mg-, and Ca-montmorillonites were equilibrated through the vapor phase with mixtures of n-C_4H_9OH with n-C_4H_9Br and n-$C_6H_{13}Br$ and n-$C_8H_{17}Br$ ranging from pure alcohol to pure bromide. Under all conditions, the alcohol was absorbed more strongly. The absorption mechanism is discussed.—JLH

06677 **Heymann, Dieter; Mazor, Emanuel; Anders, Edward.** Ages of calcium-rich achondrites—[Pt.] 1, Eucrites: Geochim. et Cosmochim. Acta, v. 32, no. 12, p. 1241-1268, illus., tables, 1968.

He, Ne, and Ar were measured in 26 eucrites and 2 howardites, and in separated mineral fractions of six eucrites. Ages were calculated using the He-3/Ar-38 ratio to infer the feldspar content and hence the correction for cosmogenic He-3 losses of the feldspars. The resulting age distribution resembles that of chondrites, ranging from ≤0.1 m.y. to 62 m.y. K-Ar ages of eucrites lie between 2.4 and 4.4 b.y. U-He ages tend to be systematically shorter, with more than one-third lying below 1 b.y. Most of the properties of eucrites are equally consistent with a lunar or an asteroidal origin.—*from* Authors' abstract

High, Lee R. *See* Picard, M. Dane. 00454

06512 **Hilchie, D. W.** Maximum temperatures recorded in wellbores: Log Analyst, v. 9, no. 5, p. 21-24, illus., 1968.

The major sources of temperature data are measurements in conjunction with well logs and drill stem tests, usually in the form of maximum wellbore temperatures which are generally assumed to occur at the greatest depth reached or bottom of the hole. Maximum temperatures are used in exploration by looking for areal changes in gradient which occur around salt domes or other structural changes in formations; formation temperatures are important in calculation of reserves, and in log interpretation mud column temperature is needed to calculate formation water resistivity. If the maximum temperature readings from well logs are to be used for geological exploration, care must be taken to ensure that anomalies observed are due to structure or thermal conductivity changes and not to a few deep holes among many shallow holes.—VSN

Hiler, Edward A. *See* Barfield, Billy J. 00496

Hillard, P. *See* Bingler, E. C. 06715

Hillard, P. *See* Bingler, E. C. 06716

00397 **Hilpman, Paul L.** Western mid-continent stratigraphy and the Kaskaskia sequence [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 14, 1969.

00494 **Hitchon, Brian.** Fluid flow in the western Canada sedimentary basin—[Pt.] 1, Effect of topography: Water Resources Research, v. 5, no. 1, p. 186-195, illus., 1969.

Main variables affecting fluid potential distribution are topography and geology; the effect of topography is treated by the three-dimensional flow net by means of fluid potential slice maps and cross sections and is shown to explain the major flow net. Dominant fluid potential corresponds closely to fluid potential at the topographic surface. Major recharge areas correspond to major upland areas, and major lowland regions are major discharge regions. Large river valleys exert a drawdown effect on fluid potential distribution, which may be observed to depths of 5,000 feet. The presence of a thick sequence of highly permeable Upper Devonian and Carboniferous carbonate rocks at medium-depth in the basin has resulted in development of a low fluid-potential drain, which channels flow from the Alberta basin towards the Athabasca oil sands and has modified the theoretical relation between local and regional flow systems.—*from* Author's abstract

06784 **Hlabse, T.; Kleppa, O. J.** The thermochemistry of jadeite: Am. Mineralogist, v. 53, nos. 7–8, p. 1281–1292, illus., tables, 1968.

The enthalpy changes associated with the mineralogical reactions (1) Albite = Jadeite + Quartz, (2) Albite + Nepheline = 2 Jadeite have been redetermined at 964°K by oxide melt solution calorimetry. For (1) we find $\Delta H°_{964} = +0.27 \pm 0.50$ kcal/mole; for (2) $\Delta H°_{964} = -6.85 \pm 0.25$ kcal/mole. When these results are combined with available heat capacity and entropy data they may be compared with the results of the room temperature thermochemical work of Kracek, Neuvonen and Burley and with high temperature–high pressure equilibrium studies. In order to achieve agreement with equilibrium work above 700°C it is essential to take into account the enthalpy and entropy changes associated with the low → high albite transformation.—Authors' abstract

06353 **Hoare, Joseph M.; Condon, William H.; Cox, Allan; Dalrymple, G. Brent.** Geology, paleomagnetism, and potassium–argon ages of basalts from Nunivak Island, Alaska, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 377–413, illus., tables, geol. map, 1968.

Geologic mapping, paleomagnetic stratigraphy, and K–Ar dating were used to determine time and volume relations of tholeiitic and alkalic basalt on Nunivak Island in the Bering Sea near the coast of Alaska. Volcanism on Nunivak Island occurred in distinct episodes separated by quiet intervals that lasted from 1.6 to 0.6 m.y. In the past 6 m.y., tholeiitic basalt erupted during at least five such episodes, and highly undersaturated alkalic basalt during three episodes. During the last tholeiitic episode, 130 cu km of basalt erupted during a well-defined interval lasting from 0.9 to 0.3 m.y. ago. A nearly contemporaneous eruption of alkalic basalt has continued to historic times with a volume from 0.7 to 2.0 percent of that of the associated tholeiite. The undersaturated alkalic basalts contain abundant ultramafic inclusions.—*from* Authors' abstract

00557 **Hodge, Dennis S.; Mayewski, Paul A.** Gravity study of a hypersthene syenite in the Laramie anorthosite complex, Wyoming: Geol. Soc. America Bull., v. 80, no. 4, p. 705–713, illus., table, 1969.

On the northwest side of the Laramie anorthosite complex, 236 gravity stations were located at 1 per sq km over a hypersthene syenite body and country rock. The hypersthene syenite is about 6×18 km, and is bordered by anorthosite, hornblende syenite, and granite gneiss. Three 15–18 mgal anomalies with maximum gradients of about 4 mgal/km are centered over the hypersthene syenite. Bouguer anomalies range from a mean of −150 mgal in the anorthosite to a high of −128 mgal over the hypersthene syenite to a mean of −150 mgal over granite gneiss. Isoanomaly lines locally crosscut geologic contacts. Computed minimum density contrasts of about $\Delta\rho = .23$ indicate that a subsurface mafic mass, possibly norite, is the principal disturbing mass and not the hypersthene syenite. Models indicate that the mass is within 0.5 kr of the surface in places and extends to a depth of about 5 km.—*from* Author's abstract

06458 **Hoffer, Jerry M.** Order–disorder relationships of plagioclase in a porphyritic basalt flow: Am. Mineralogist, v. 53, nos. 5–6, p. 908–916, illus., 1968.

The structural state of phenocryst and groundmass plagioclase from a thick porphyritic flow of the Columbia River Basalt ranges from high to intermediate disorder. Two groups have been differentiated: (1) Groundmass plagioclase in a lower structural state than phenocrysts; the groundmass plagioclase is more calcic than the An_{50} and of small size. (2) Groundmass plagioclase in a higher structural state than phenocrysts; groundmass plagioclase generally less calcic than An_{50} and of large size. The latter group contains smaller amounts of glass than those of group one. The reversal in structural state relationship between the phenocryst and groundmass plagioclase of (2) is probably due to the sluggishness of the transformation from disorder to order in plagioclase less calcic than An_{50}.—Author's abstract

Holland, H. D. *See* Kinsman, David J. J. 00546

06741 **Holland, William J.; Bozic, John; Gerard, J. T.** Di-2-pyridylketoxime, a new reagent for the spectrophotometric determination of iron(II) [with French and German abs.]: Anal. Chim. Acta, v. 43, no. 3, p. 417-422, illus., tables, 1968.

Di-2-pyridylketoxime is proposed for the spectrophotometric determination of iron (II). The complex is stable and exhibits an absorption maximum at 534 nm in an alkaline citrate medium. Beer's law is obeyed and the molar absorptivity is $1.5 \cdot 10^3$. Large amounts of copper and nickel can be tolerated. The method is simple, convenient and reproducible.—Authors' abstract

Hollander, N. B. *See* Saxena, S. K. 00478

06551 **Hollenbaugh, Kenneth Malcolm.** Geology of a portion of the north flank of the San Bernardino Mountains, California [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2087B-2088B, 1968.

00398 **Honderich, Jeff P.** Tertiary chert gravel in northeastern Kansas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 14-15, 1969.

Honea, R. M. *See* Walker, T. R. 00621

06452 **Hood, William C.** An X-ray background method for the determination of total iron in trioctahedral micas: Am. Mineralogist, v. 53, nos. 5-6, p. 1054-1056, illus., 1968.

The background intensity can be used in X-ray diffraction analysis to estimate total amount of iron present when no other element with mass absorption coefficient close to iron is present in appreciable quantities, matrix effects are constant, and a series of analyzed standards is available. The method is illustrated here on a group of trioctahedral micas; the method should be applicable to other mineral groups where isomorphous substitution of iron takes place for another element with a much smaller mass absorption coefficient.—VSN

06404 **Horvath, R.; Lowe, D. S.** Multispectral survey in the Alaskan Arctic, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 483-496, illus., 1968.

An aerial survey in the vicinity of Point Barrow, Alaska during the fall of 1967 is described. Calibrated multispectral data were obtained for common Arctic features such as sea ice, thaw lakes, and polygonal soils under a variety of conditions. Quantitative and qualitative ground truth data were also acquired. Full scale analysis of these data has not yet been undertaken, but representative image examples are presented and the results of limited analysis described.—Authors' abstract

00572 **Horz, F.; Ahrens, Thomas J.** Shock metamorphism of biotite to forty kb [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 58-59, 1969.

Houston, Robert S. *See* Hyden, Harold J. 06487

00466 **Howard, Hildegarde.** A new avian fossil from Kern County, California: Condor, v. 71, no. 1, p. 68-69, illus., 1969.

A new marine avian genus and species, *Plotopterum joaquinensis*, has been identified from the Pyramid Hill sands of the San Joaquin Valley, California. *Plotopterum* represents a trend in aquatic adaptation distinct enough from either of the two existing groups to warrant the designation of a separate family, to be known as the Plotopteridae.—KAF

00512 **Hoyt, John H.** Chenier versus barrier, genetic and stratigraphic distinction: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 299-306, illus., 1969.

Chenier development begins with progradation by rapid deposition. This is followed by a period of reworking, shore retreat, and formation of a ridge along the landward side of a beach. Sand is concentrated on the upper beach and on top of the adjacent

marsh. The contact of the chenier with underlying marsh and mudflat deposits is disconformable in areas of shore retreat, but the chenier may intertongue with finer sediments laterally along the shore. Barriers originate from a topographic ridge along the landward side of a beach which subsequently is partly submerged. Lagoonal–marsh sediments are deposited behind the barrier; however, continued submergence accompanied by transgression may result in intertonguing of barrier and lagoonal–marsh sediments. Generally, barriers predate the lagoonal–marsh sediments.—*from* Author's abstract

Huh, John M. *See* Hardy, Ronald G. 06370

06372 **Huh, John M.; Hardy, Ronald G.; Plummer, Norman; Bauleke, Maynard P.** Testing of Kansas clays or shales for non–ceramic utilization, *in* Short papers on research in 1967: Kansas Geol. Survey Bull. 191, pt. 1, p. 17–19, illus., tables, 1968.

Kansas clays have been extensively tested for ceramic use. A series of tests to evaluate the nonceramic uses has been instigated and indications are that certain clays or shales may have application as filler or for use as agrichemical carriers.—Authors' abstract

Hurlbut, C. S., Jr. *See* Leavens, Peter B. 06770

06657 **Hurlbut, Cornelius S., Jr.** Minerals and man: New York, Random House, 304 p., illus., table [1968?].

This nontechnical discussion of minerals has 19 chapters as follows: minerals and how to know them—crystal form, geological occurrence, properties; early uses; the earth and its rock; minor minerals; nature's treasure house—pegmatites; the traprock suite—zeolites; crystals in sedimentary rocks; evaporites from the sea; those of land–locked lakes; native metals; common ore minerals; fluorescence; iron and its ores; precious stone; quartz varieties; colored stones and ornamental minerals; uranium minerals; Cornish tin and other ore minerals; incombustible asbestos and burnable sulfur. An appendix tabulates properties of some common minerals; color photographs show rare and unusual crystals.—GDC

06487 **Hyden, Harold J.; Houston, Robert S.; King, John S.** Geologic map of the White Rock Canyon quadrangle, Carbon County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ–789, scale 1:24,000, section, text, 1968.

Although oil is produced in nearby areas, structures in the White Rock Canyon quadrangle revealed at the surface appear unfavorable for appreciable accumulations.—MCM

Iijima, A. *See* Hay, R. L. 06356

Imbimbo, Eugene S. *See* Friedman, Gerald M. 06599

00567 **Innes, M. U S.** Regional gravity mapping in Canada [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 57, 1969.

06399 **Innes, Richard B.** An interpreter's perspective on modern airborne–radar imagery, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 107–122, illus., 1968.

The differences between sidelooking radar imagery and photography and how they affect the interpretation of the imagery are discussed.—GWL

06695 **Irish, E. J. W.** Structure of the northern Foothills and eastern mountain ranges, Alberta and British Columbia, between latitudes 53°15′ and 57°20′ [with French abs.]: Canada Geol. Survey Bull. 168, 38 p., illus., table, 1968.

North of Athabasca River in western Alberta, and between Pine and Sikanni Chief Rivers in British Columbia, compressive stress has been relieved by northeastward thrusting of large masses of strata on southwest–dipping fault surfaces, and by

contemporaneous folding. Most folds appear related dynamically to an underlying thrust fault and/or to pass laterally along strike into a thrust fault. East-dipping axial planes of some folds and high-angle dip subsidiary thrust faults are both results of southwestward rotation of hanging-wall strata due to eastward movement on underlying concave-upward thrust surfaces. Spacing between thrust faults, their length, and amount of movement on each are dependent on relative competency and thickness of the stratigraphic sequence. The same factors also appear to determine relative predominance of either folding or faulting as a deforming process.—*from* Author's abstract

Isacks, Bryan. *See* Oliver, Jack. 06635

06449 **Ito, Jun; Frondel, Clifford.** Synthesis of the grossularite-spessartite series: Am. Mineralogist, v. 53, nos. 5-6, p. 1036-1038, illus., 1968.

Summaries of garnet analyses by Frondel and Ito (1965) have indicated that probably a complete series extends under some natural conditions between grossularite and spessartite. This note reports the synthesis of end-compositions and four compositions between $Ca_3Al_2(SiO_4)_3$ and $Mn_3Al_2(SiO_4)_3$. The solid solubility in this series appears to be complete.—VSN

06457 **Ito, Jun.** Silicate apatites and oxyapatites: Am. Mineralogist, v. 53, nos. 5-6, p. 890-907, illus., tables, 1968.

Various synthetic compounds of the silicate-apatite group are isomorphous with the minerals abukumalite, beckelite, britholite and lessingite. Complete solid solution exists between hydroxylapatite and abukumalite. Unit-cell dimensions of all compounds and indexed X-ray powder data of the typical end compounds are tabulated. Infrared spectroscopic analysis, water determination by two different methods, and differential thermal analysis of selected compounds demonstrated the presence of OH in silicate-apatite and its absence in oxyapatite. New fluorescent yttrium and gadolinium analogues of oxyapatites activated by europium and terbium were prepared.—*from* Author's abstract

Ito, Jun. *See* Frondel, Clifford. 06585

Ito, Jun. *See* Frondel, Clifford. 06773

Ito, Jun. *See* Klein, Cornelis, Jr. 06782

06783 **Ito, Jun; Frondel, Clifford.** Syntheses of the scandium analogues of aegirine, spodumene, andradite and melanotekite: Am. Mineralogist, v. 53, nos. 7-8, p. 1276-1280, tables, 1968.

Unit cell dimensions and optical data are given for synthetic members of the series aegirine to sodium-scandium pyroxene; spodumene to lithium-scandium pyroxene; andradite to calcium-scandium garnet; and the scandium, gallium, and chromium analogues of lead melanotekite. The role of scandium as a trace element can be interpreted as involving diadochy with ferric iron and aluminum.—JSH

00433 **Jacka, Alonzo D.** Observations on sandstone cementation [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 208, 1969.

Jackson, M. L. *See* Wildman, W. E. 06756

00549 **Jacobs, Marian B.; Ewing, Maurice.** Mineral source and transport in waters of the Gulf of Mexico and Caribbean Sea: Science, v. 163, no. 3869, p. 805-809, illus., 1969.

Mineral particles suspended in the Gulf of Mexico and Caribbean Sea were analyzed in relation to clay mineral distributions in bottom sediments, to sedimentation processes active in the region, and to the prevailing currents. Circulation in the upper layers of water flowing from the Caribbean, carrying a micaceous-rich mineral assemblage, has exercised an influence on mineral transport into the Gulf of Mexico, different from the montmorillonite-rich load delivered by the Mississippi River.

Particulate matter, suspended in North Atlantic water and Amazon River discharge, enters the Caribbean through the Lesser Antilles and contributes to the detrital mineral content of Caribbean water, as does that carried by the wind.—Authors' abstract

00489 **Jarred, Harry M.** Phillip A. Bloomer, Jr. (1922–1967): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 440–441, portrait, 1969.

00399 **Jefferis, Lee H.** A radar lineament analysis of the Grand Canyon area, northern Arizona [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 15, 1969.

Jeffrey, H. G. *See* Emmett, L. F. 06567

06514 **Jeffries, Frank.** Reservoir volume calculations with a well data system: Log Analyst, v. 9, no. 3, p. 3–11, illus., tables, 1968.

A small data system used in the editing and integration of core analyses and well logs from about 1,500 wells in various oil pools of the South Swan Hills and Judy Creek oil fields of northern Alberta is described. Input data for the reservoir analysis is on three tapes—log interpretation, core analysis, and general well data. Computer print-out is produced in tables for each well and shows well location, field and core-depth adjustment, and tabulated data for each core plug including plug thickness, porosity, permeability, average acoustic porosity over plug interval, and feet of mud cake and microlog porosity.—VSN

06691 **Jessen, H.** A Devonian osteolepidid fish from British Columbia [with French abs.]: Canada Geol. Survey Bull. 165, p. 65–70, 44–45, illus., 1968.

The almost complete fronto-ethmoidal shield of an undoubted osteolepidid fish is recorded from the upper Middle Devonian Nahanni (Hume) Formation of north-central British Columbia. It is ascribed to a new species, *Gyroptychius? taylori*.—Author's abstract

Joensuu, Oiva. *See* Bonatti, Enrico. 06443

Johannes, Wilhelm. *See* Althaus, Egon. 00504

06365 **Johnsen, John H.** The geology and mineral resources of the Hudson estuary, *in* Hudson River ecology—Symposium, 1966, Tuxedo, N.Y.: [Albany] Hudson River Valley Comm. New York, p. 8–40, illus. [1968?].

From the Albany-Troy area to the Newburgh-Beacon region, the Hudson River flows through the Hudson Lowland, developed by erosion of weak shales; elevations and relief are low. From Newburgh to New York City the river cuts through the metamorphic and igneous rocks of the New England Upland. The Hudson Highlands on the north have considerable relief but the topography is more subdued to the south where the river follows the eastern border of the Triassic lowland. The Hudson breaches the coastal plain at its mouth. The various rocks and mineral resources in each province are discussed briefly and numerous areal photographs show important features of the topography. Half of the river is in the tidewater and is considered estuarine.—HRC

06477 **Johnson, Noye M.; Ragle, Richard H.** Analysis of flow characteristics of Allen II slide from aerial photographs, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 369–373, illus., 1968.

The many rock-snow slides that followed from the Alaska earthquake of March 27, 1964, illustrated a variety of flow mechanics. The form of some slides suggests a complete turbulence during flow, while the form of others gives evidence for steady-state flow or for controlled shearing.—Authors' abstract

06564 **Johnson, Rockne Hart.** The synthesis of point data and path data in estimating sofar speed [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2094B, 1968.

00427 **Johnson, Ross B.** Geologic map of the Trinidad quadrangle, south-central Colorado: U.S. Geol. Survey Misc. Geol. Inv. Map I-558, scale 1:125,000, 1969.

Jones, D. L. *See* Repenning, C. A. 00600

06750 **Jones, Francis T.** Spindle stage with easily changed liquid and improved crystal holder: Am. Mineralogist, v. 53, nos. 7-8, p. 1399-1403, illus., 1968.

A glass cell for refractive index liquids and a crystal mounting arrangement are described. These are adaptable to most spindle stages with resultant improvement in convenience and efficiency of use.—Author's abstract

00487 **Jones, Larry L.** Lower Cretaceous geology, northwestern Karnes County, Texas—Discussion [of paper by Delos R. Tucker, 1968]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 436-437, 1969.

Tucker (ibid., v. 52, p. 820-851, 1968) stated that faulting in the areas of the Karnes trough in northwestern Karnes County, Texas cannot be accurately dated, but that he believes it started after the Early Cretaceous, with the latest activity in the Sample System Faults after Early Miocene. Two additional wells not used by Tucker suggest that the age of faulting was contemporaneous with deposition.—SEF

00613 **Jones, Robert S.** Gold in igneous sedimentary, and metamorphic rocks: U.S. Geol. Survey Circ. 610, 28 p., tables, 1969.

Gold analyses are compiled for 50 rock types of which >50 percent are igneous, 30 percent sedimentary, and the remainder metamorphic. Separate lists are given for analyses prior to 1955 which tend to be higher than newer analyses. Data from neutron-activation analyses indicate that igneous rocks contain from 0.2 to 73 ppb gold with average of 3.0 ppb. Averages for plutonic rock types are: granite, 2.8; syenite, 2.5; diorite, 3.5; gabbro 5.4; and dunite, 8.2. Averages for volcanic rock types are: rhyolite, 12; trachyte, 6.5; andesite, 5.2; and basalt, 3.2. Sedimentary rocks contain from 0.3 to 41 ppb with an average of 5.0 ppb, and metamorphic rocks from 0.86 to 22.4 ppb with average of 4.3. In nonauriferous regions, gold analyses show only a few parts per billion; in auriferous, they are one to two magnitudes higher.—*from* Author's abstract

06733 **Jopling, Alan V.; Walker, Roger G.** Morphology and origin of ripple-drift cross-lamination, with examples from the Pleistocene of Massachusetts: Jour. Sed. Petrology, v. 38, no. 4, p. 971-984, illus., 1968.

Different types of ripple-drift cross-lamination occur on forsets of a kame delta near Concord, Mass. A morphological classification is proposed, based on end members of a sequence of forms: type A, characterized by non-preservation of stoss-side laminae, and consisting of climbing sets of lee side laminae; and sinusoidal ripple lamination (new term), a series of ripples with symmetrical, sine-wave profiles and continuous laminae across the system. One intermediate type (B) is defined between end members. Extension into a genetic classification is based on ratio of sediment fallout from suspension to sediment moved as bed load. Cross-lamination originated from density underflows of sediment-laden meltwater flowing into a glacial lake; the different types are due to small fluctuations in current velocity and variations in composition and concentration of suspended sediment.—*from* Authors' abstract

00400 **Jordan, Michael A.** Garnetiferous metagabbro near Babyhead, Llano County, Texas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 15, 1969.

06461 **Joshi, M. S.; Kotru, P. N.** Hillocks on first-order prism faces of synthetic quartz: Am. Mineralogist, v. 53, nos. 5-6, p. 825-839, illus., 1968.

Square-shaped growth hillocks observed on first-order prism faces of synthetic quartz are illustrated. These hillocks interact with growth layers from other initiating centres and lead to the modification of the shapes of such hillocks. Pits at the

centres of hillocks are related to linear defects, probably screw dislocations. Possible twin boundaries bound areas of differing hillock orientation.—Authors' abstract

Joshi, R. C. *See* Lohnes, R. A. 06644

06508 **Judson, Sheldon.** Erosion of the land, or what's happening to our continents?: Am. Scientist, v. 56, no. 4, p. 356–374, illus., tables, 1968.

A general discussion about rates of erosion is presented. Modern records (tombstones, landslides, creep, archeological sites, etc.) are reviewed, as are river-load records and human factors. Estimates for worldwide erosion rates are calculated; for instance, prior to man, 9.3×10^9 tons of material per yr were carried by streams to the oceans, and about 10^8 are removed by the wind; glacial ice may remove a similar amount. The increase since man's appearance is appreciable, perhaps by as much as a factor of two or three. The amount of material deposited in the oceans today, calculated from cores, is 6.2 to 11.2×10^9 tons per yr. Isostasy is discussed as a key to survival of continents.—HRC

00514 **Jung, Peter.** Miocene and Pliocene mollusks from Trinidad: Bulls. Am. Paleontology, v. 55, no. 247, p. 293–657, illus., 1969.

A total of 325 species, including 47 new named and many unnamed species, of scaphopods (4), pelecypods (115), and gastropods (206), are described from three stratigraphic units, in the Melajo River and Matura areas in northeast Trinidad and Point Courbaril in the southwest. The fauna of the Melajo clay member of the Springvale Formation, 168 species, is correlated with the late Miocene Savaneta glauconitic sandstone member of the Springvale, but part of the Melajo may be younger. The fauna of the Courbaril sand and clay member of the upper Morne l'Enfer Formation, 96 species, is considered early Pliocene, as is the slightly younger fauna, 160 species, of the Matura sand and clay member of the Talparo Formation.—VMJ

Kaarsberg, Ernest A. *See* Sturm, Rolland G. 06719

06764 **Kaarsberg, Ernest A.** Elasticity studies of isotropic and anisotropic rock samples: Soc. Mining Engineers Trans., v. 241, no. 4, p. 470–475, illus., 1968.

Experimental evidence from longitudinal- and shear-wave pulse velocity measurements on isotropic steel samples show, within error limits, that any two of the elastic constants required to describe the elasticity of an isotropic solid can be obtained from any two of four velocity measurements: longitudinal rod, plate, extended medium, or shear wave. Measurements of three of these velocities in an approximately isotropic basaltic rock sample illustrate application to isotropic rocks. For the anisotropic study, a suite of Colorado oil shales exhibited transverse isotropy. The five elastic constants required to specify this type of anisotropy are obtained from longitudinal- and shear-wave pulse velocity measurements made in directions parallel, perpendicular, and at 45° to the bedding plane. Density, velocity, and elastic modulus relationships among these shales are given also.—*from* Author's abstract

Kalafus, R. M. *See* Ewen, H. I. 06394

Karplus, Walter J. *See* Vemuri, Venkateswararao. 00493

Kasahara, Komei. *See* Kubo, Yasushi. 06584

Katsura, T. *See* Forbes, Robert B. 00614

06655 **Kaula, William M.** An introduction to planetary physics—The terrestrial planets: New York and London, John Wiley and Sons, 490 p., illus., tables, 1968.

The contents of this textbook can be divided into five parts: The first, planetary interiors, comprises three chapters on data pertaining to the Earth's interior, mechanical and thermal aspects of planetary structure, and electromagnetism of a planetary interior. (2) The dynamics of the solar system contains two chapters on

the Earth–Moon and planetary systems. (3) Other types of observations form two chapters on planetary surfaces and interpretation of the geology of the Moon and Mars. (4) Properties, classification, chemistry, composition, structure, and origin of meteorites and tektites are outlined. (5) Evidence and hypotheses toward an understanding of the origin and evolution of the planets are assembled.—ESL

00463 **Keefer, William R.** Geology of petroleum in Wind River basin, central Wyoming [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 219, 1969.

Keith, Terry E. C. *See* Muffler, L. J. Patrick, 00477

Keller, Stanley J. *See* Carpenter, G. L. 06665

Keller, W. D. *See* Reesman, A. L. 00470

Keller, W. D. *See* Reesman, A. L. 06583

00441 **Kelley, Vincent C.; Melancon, Paul E.; Kittel, Dale F.** Uranium deposits of Grants region [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 212, 1969.

06552 **Kern, John Philip.** Early Pliocene paleoecology of the eastern Ventura basin, southern California [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2088B, 1968.

Kerr, J. William. *See* Thorsteinsson, R. 06570

00401 **Kessler, L. G., 2d.** Paleoenvironmental and stratigraphic implications of palynomorph distribution in the Glen Rose Formation (Lower Cretaceous), north and central Texas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 16, 1969.

Kester, D. R. *See* Pytkowicz, R. M. 00474

06718 **Key, Charles R.; Moss, George J., Jr.; MacDonald, Frank H.** Precision bathymetric detector, *in* Marine sciences instrumentation, V. 4—Instrument Soc. America Symposium, 4th Natl., Cocoa Beach, Fla., 1968, Proc.: New York, Plenum Press, p. 78–86, illus., 1968.

During a cruise of the USNS SILAS BENT in the Bermuda area during the autumn of 1966, Oceanographic Instrumentation Center personnel studied effects of topography and bottom structure on the performance of narrow-beam bathymetric sonar systems. It was concluded that the effects of side-lobe interference could be reduced by means of a variable-threshold peak detector. A detection process was devised, involving use of delay-line look-ahead techniques for prediction of pulse amplitudes, and control of the detection threshold. Tests over the continental slope near San Francisco demonstrated that the bathymetric peak detector reduced the effective beam width by improving the rejection of side-lobe arrivals.—*from* Authors' abstract

00552 **King, E. A., Jr.; Schonfeld, E.; Richardson, K. A.; Eldridge, J. S.** Meteorite fall at Pueblito de Allendo, Chihuahua, Mexico—Preliminary investigation: Science, v. 163, no. 3870, p. 928–929, illus., table, 1969.

Specimens from the meteorite fall at 1:05 a.m. on February 8, 1969 at Pueblito de Allendo, Chihuahua, Mexico, have been recovered. The meteorite is a chondrite (03 and 04) with both opaque and microcrystalline matrices. Specimens were brought to a low background gamma counter less than 4.5 days after the fall, and gamma rays from short-lived isotopes have been observed.—Authors' abstract

King, John S. *See* Hyden, Harold J. 06487

King, L. H. *See* Rashid, M. A. 00584

00546 **Kinsman, David J. J.; Holland, H. D.** The co-precipitation of cations with $CaCO_3$ [Pt.] 4, The co-precipitation of Sr^{2+} with aragonite between 16° and 96°C: Geochim. et Cosmochim. Acta, v. 33, no. 1, p. 1–17, illus., tables, 1969.

The distribution coefficient for Sr coprecipitated with aragonite from sea water decreases linearly with temperatures from 1.17 ± 0.04 at 16°C to 0.88 ± 0.03 at 80°C. The coprecipitation process is controlled by surface processes and follows the Doerner–Hoskins law. The distribution coefficient does not vary with the rate of precipitation of aragonite in this set of experiments. It seems likely that its value is either determined by a single step in the incorporation of cations in aragonite crystals, or that the distribution coefficients for a number of steps in the incorporation process are very nearly the same. The value of the distribution coefficient for coprecipitation Sr found in these experiments at 96°C differs from the value obtained in an earlier set of experiments carried out in $CaCl_2$ $Ca(CCl_3COO)_2$ solutions. Part of the difference is due to the presence of sulfate in sea water.—KAF

Kirk, J. L. *See* Schmidt, E. D. D. 06751

Kirk, J. Norman. *See* Dellwig, Louis Field. 06386

Kittel, Dale F. *See* Kelley, Vincent C. 00441

06778 **Klein, Cornelis, Jr.** Antimonian groutite—A correction: Am. Mineralogist, v. 53, nos. 7–8, p. 1417, 1968.

Corrections are given to errors and omissions in indexing of X-ray diffraction pattern of antimonian groutite originally reported by Klein and Frondel, ibid., v. 52, p. 859, 1967.—VSN

06782 **Klein, Cornelis, Jr.; Ito, Jun.** Zincian and manganoan amphiboles from Franklin, New Jersey: Am. Mineralogist, v. 53, nos. 7–8, p. 1264–1275, illus., tables, 1968.

Zincian and manganoan amphiboles occur as coarse-grained, irregular masses in the skarn zones of the Franklin orebody. These amphiboles are associated mainly with calcite, rhodochrosite, rhodonite, tephroite, andradite, willemite and franklinite. Chemical analyses, optical and X-ray parameters, and assemblage descriptions are given for three cummingtonites, nine members of the tremolite–actinolite series and one magnesioriebeckite. The cummingtonites show maximum ZnO and MnO contents of 10.8 and 13.79 weight percent respectively; members of the tremolite actinolite series contain smaller amounts of ZnO and MnO, the maxima being 9.54 and 5.42 weight percent respectively; a magnesioriebeckite contains 7.84 weight percent ZnO and 4.16 weight percent MnO.—*from* Authors' abstract

Klein, Edward. *See* Legeros, Racquel Z. 06377

06588 **Klein, George deVries.** Report on advanced seminar on intertidal zone sedimentation, Minas Basin, Bay of Fundy, Nova Scotia, Canada, July 6 to August 11, 1968: Maritime Sediments, v. 4, no. 2, p. 52–56, 1968.

This seminar, held in Parrsboro, Nova Scotia, was attended by 12 graduate students in geology and oceanography from the United States and Canada. Field trips for observation and collection visited four sand bars and a small area of gravel sedimentation. Abstracts of reports on individual research projects by each of the participating students are cited separately. Additional one-day trips were made to visit a salt mine at Pugwash, the Atlantic Oceanographic Laboratory at Dartmouth, and the Russian Oceanographic Vessel, R. V. *Mikhail Lomonosov*, at Halifax. During the seminar, lectures were given by the teaching staff, participants, and visiting geologists.—GDC

00432 **Klement, Karl W.** Phylloid algal banks [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 207–208, 1969.

Kleppa, O. J. *See* Hlabse, T. 06784

Klepper, M. R. *See* Robinson, G. D. 06502

06650 **Knopoff, L.** The seismic properties of isotropic two-component systems [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 8–9, 1968.

Koch, Robert C. *See* McCrone, Alistair W. 06366

06667 **Koelzer, Victor A.; Bauer, William J.; Dalton, Frank E.** The Chicagoland Deep Tunnel Project: Interstate Oil Compact Comm. Comm. Bull., v. 10, no. 2, p. 15–35, illus., 1968.

This ten-year construction project to control floods and pollution involves much tunneling and cavern digging. Overflow of storm water from combined sewers in the naturally swampy Chicago area is captured by the deep tunnel system, upstream from its outfall into the waterway, through vertical shafts to a network of tunnels which convey it under large head to mined storage reservoirs in Galena-Platteville dolomites, 600 to 850 feet below land surface. After partial treatment in settling chambers, stored water is pumped through reversible turbines to surface reservoirs for further quality improvement and gradual release to the waterway. Surface and lower reservoirs are also used for hydroelectric generation. A stratigraphic column summarizes aquifer and drilling properties of Cambrian-Silurian formations.—GDC

Kotru, P. N. *See* Joshi, M. S. 06461

06388 **Kover, Allan N.** Sidelooking radar imagery, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 781–785, illus., 1968.

High-resolution sidelooking radar imagery was obtained for the Earth Resources Survey Program of the National Aeronautics and Space Administration (NASA). The several images that have appeared in the scientific and popular press have evoked much interest. The published pictures represent a very small fraction of the several hundred thousand square miles imaged in 112 flight hours. There is at least token imagery in 45 States. Much of this coverage was obtained in point-to-point flying between test sites. A new source of radar imagery, a sidelooking imager installed in a NASA aircraft, is scheduled to become operational late this summer.—Author's abstract

06591 **Kravitz, Joseph H.** Splitting core liners with a mica undercutter: Jour. Sed. Petrology, v. 38, no. 4, p. 1358–1361, illus., 1968.

The mica undercutter is a simple, effective instrument for splitting open core liners. Its ease of operation and portability make it an ideal tool for both laboratory and shipboard work.—Author's abstract

06727 **Krinsley, David; Donahue, Jack.** Pebble surface textures: Geol. Mag., v. 105, no. 6, p. 521–525, illus., 1968.

An electron microscope examination of beach and glacial pebbles suggests that these two environments do not impress distinctively different textures on pebble surfaces. A detailed study of the surface textures of beach pebbles indicates that the size reduction is predominantly an abrasional rather than solutional process. The three textural features noted, flat planar surfaces, pits, and arc-shaped fractures, were characterized by an abundance of mechanical breakage blocks slightly modified by solution. All three textural types were experimentally duplicated.—Authors' abstract

06703 **Krumbein, W. C.** FORTRAN IV computer program for simulation of transgression and regression with continuous-time Markov models: Kansas Geol. Survey Computer Contr. 26, 38 p., illus., tables, 1968.

The models can be adapted to a variety of lateral-shift processes. In this report a clastic-wedge model is used to generate equally spaced borehole or outcrop sections that show type of deposit formed as environments shift back and forth. States of the transgressive-regressive system can be defined in terms of position of the strandline through time, with accumulating sediments representing responses

to particular environments as they successively occupy a given monitoring station. Simulations are performed with a transition-rate matrix, although the transition-probability matrix can also be adapted to lateral-shift processes. A computer program is listed for shifting from one matrix to the other. The main simulation program is illustrated with an experimental example; the body of the text discusses some of the implications involved in structuring Markov models as continuous-time, discrete state mechanisms.—*from* Author's abstract

06584 **Kubo, Yasushi; Yamaguchi, Goro; Kasahara, Komei.** Kinetic and electron optical studies of the reaction process between kaolinite and sodium carbonate: Am. Mineralogist, v. 53, nos. 5–6, p. 917–928, illus., table, 1968.

The system kaolin–1.5 Na_2CO_3 was studied at temperatures 650° to 800°C, and inversion of high-carnegieite-like phase (L-phase) to nepheline was examined in relation to starting materials. The L-phase from metakaolin inverts more readily to nepheline than that produced from well-crystallized kaolinite. Excess alkali (>1 mole Na_2CO_3) stabilizes an alkali-rich carnegieite at around 800°C. Electron optical examinations at various stages of the reaction reveal topotactic relationships between the original and product phases. From these observations and kinetic data, the process is interpreted in terms of the random distribution of Na ions in the L-phase which has a similar Si-O framework to that of the starting material. Authors' abstract

00490 **Kugler, Hans G.** Ernst J. Lehner (1895–1968): Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 441–442, portrait, 1969.

06753 **Kushiro, Ikuo; Aoki, Ken-ichiro.** Origin of some eclogite inclusions in kimberlite: Am. Mineralogist, v. 53, nos. 7–8, p. 1347–1367, illus., tables, 1968.

Of six eclogite inclusions, three are essentially bimineralic eclogites consisting of clinopyroxene and pyrope-rich garnet, and others contain additional phlogopite. Clinopyroxenes range in composition from jadeite 9.9 mole percent to jadeite 40.8 percent. Garnet ranges in composition from grossular 2.9 to 18.1 percent. Partition of Mg and Fe^{2+} between coexisting garnet and clinopyroxene in these eclogites is similar to those in the eclogites from other kimberlite pipes, but much different from those in eclogites from various metamorphic terrains. The compositions of the eclogites correspond to those of olivine basalt or picrite basalt, although K_2O content is high in two of them. As the $Fe^{2+}/(Mg+Fe^{2+})$ ratio increases, Al_2O_3 increases, and content of jadeite in clinopyroxene and content of grossular in garnet increase.—*from* Authors' abstract

06475 **LaChapelle, Edward R.** The character of snow avalanching induced by the Alaska earthquake, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 355–361, illus., table, 1968.

The Alaska earthquake occurred at a time of natural avalanche hazard in the Chugach Mountains and apparently in nearby mountain ranges as well. The first earth motions triggered many surface avalanches in the naturally unstable snow; subsequent earth motions dislodged snow cornices and normally stable snow. Avalanches following these latter events removed snow down to the ground, and were the largest and most destructive; they often incorporated mud and other debris. The average density of one avalanche per square mile was not unusual for an entire normal winter, but was unique in that all the avalanches occurred at the same time.—*from* Author's abstract

Lajoie, Jean. *See* Ayrton, William G. 00625

Lajoie, K. R. *See* Gilbert, C. M. 06355

06594 **Landim, Paulo M. B.; Frakes, Lawrence A.** Distinction between tills and other diamictons based on textural characteristics: Jour. Sed. Petrology, v. 38, no. 4, p. 1213–1223, illus., tables, 1968.

Statistical parameters of the granule-to-clay size-frequency distribution efficiently differentiate till from alluvial-fan deposits and from outwash deposits. Discriminant

functions utilizing mean, standard deviation, skewness, and kurtosis also separate the three types of sediment. As a test of the method, samples of fossil mudflow were studied; they plot in the area of alluvial-fan deposits.—Authors' abstract

06450 **Landis, C. A.; Rogers, J.** Some experimental data on the stability of pumpellyite: Am. Mineralogist, v. 53, nos. 5–6, p. 1038–1041, illus., 1968.

Natural pumpellyite + quartz decomposed in hydrothermal experiments at 500–550°C and 500–3000 atm to anorthite and clinopyroxene. Pumpellyite could not be conclusively crystallized using the decomposition products or oxide mixes.—JSH

06651 **Landisman, M.; Sato, Y.; Usami, T.; Masse, R.** Some recent results from the study of theoretical seismograms [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 9, 1968.

06726 **Lange, G. Robert.** Rotary drilling and coring in permafrost—Pt. 1, Preliminary investigation, Fort Churchill, Manitoba: U.S. Army Materiel Command Cold Regions Research and Eng. Lab. Tech. Rept. 95, 18 p., illus., tables, 1968.

A small rotary drill rig was instrumented and used at Fort Churchill, Manitoba, to investigate the problems of drilling and coring in permafrost. Small diameter augers were also tested. Adequate rates of penetration were easily achieved. However, difficulties were encountered when hole walls and core were thawed by warm drilling fluid. Some success was achieved when coring with water cooled by ice. It was concluded that the feasibility of using a low freezing point liquid and/or compressed air and a portable refrigerator should be investigated.—Author's abstract

06738 **Langmyhr, F. J.; Paus, P. E.** The analysis of inorganic siliceous materials by atomic absorption spectrophotometry and the hydrofluoric acid decomposition technique—Pt. 1, The analysis of silicate rocks [with French and German abs.]: Anal. Chim. Acta, v. 43, no. 3, p. 397–408, tables, 1968.

The analysis of various inorganic siliceous materials of geological and industrial interest is discussed. The methods proposed are based on decomposition of a single sample by hydrofluoric acid and determination by atomic absorption spectrophotometry of up to 10 constituents. General procedures are described, and details are given for the determination of silicon, aluminium, total iron, magnesium, calcium, sodium, potassium, titanium and manganese in silicate rocks. Analytical data are given for the analysis of reference rocks G-2 and W-1.—Authors' abstract

06739 **Langmyhr, F. J.; Paus, P. E.** The analysis of inorganic siliceous materials by atomic absorption spectrophotometry and the hydrofluoric acid decomposition technique—Pt. 3, The analysis of bauxite: Anal. Chim. Acta, v. 43, no. 3, p. 508–510, table, 1968.

Methods for the determination of silicon, aluminum, iron, magnesium, calcium, sodium, potassium, titanium, manganese, and chromium are presented. The suggested methods were tested by analyzing U.S. National Bureau of Standards sample 69A, bauxite; data are tabulated.—ESL

06565 **Larson, Jerome Valjean.** A cross correlation study of the noise performance of electrostatically controlled La Coste and Romberg gravimeters [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2094B, 1968.

06755 **Leavens, Peter B.** New data on whewellite: Am. Mineralogist, v. 53, nos. 3–4, p. 455–463, illus., tables, 1968.

Quite pure whewellite of ideal composition, $CaC_2O_4 \cdot H_2O$, occurs in septarian nodules near Milan, Erie County, Ohio, associated with calcite, dolomite, barite, and pyrite. Refined unit cell dimensions are: $a = 6.276$, $b = 14.561$, $c = 10.012$ A, $\beta = 107°05'$; space group $P2_1/n$. Optically, biaxial positive, $\alpha = 1.489$(b), $\beta = 1.553$, $\gamma = 1.649$ (all $\pm$ 0.003), 2V about 80°; H is about 3. Specific gravity is 2.21 (meas.), 2.22 (calc.). Cleavages are (101) very good, (001) and (010) distinct, (110) indistinct. Available free energy data indicates that whewellite is metastable in almost all

natural environments. It may form from the metastable precipitation of oxalates released during the decomposition of organic matter.—MEM

06770 **Leavens, Peter B.; Hurlbut, C. S., Jr.; Nelen, Joseph A.** Eucryptite and bikitaite from King's Mountain, North Carolina: Am. Mineralogist, v. 53, nos. 7–8, p. 1202–1207, illus., tables, 1968.

Vein fillings in the King's Mountain pegmatite yield good eucryptite crystals with a = 13.490, c = 9.016±0.007 A, a:c = 1:0.6684 (X-ray), 1:0.6685 (morph.). Bikitaite had a = 8.614, b = 4.957, c = 7.603±0.22 A, β = 114° 19.3′ (X-ray). Chemical analyses yielded the formulas $(Li_{5.80}Na_{0.06})Al_{5.98}Si_{6.05}O_{24}$ for eucryptite and $Li_{2.10}Al_{2.00}Si_{3.97}O_{12}\cdot 1.95H_2O$ for bikitaite.—Authors' abstract

06732 **Legault, J. A.** Conodonts and fish remains from the Stonehouse Formation, Arisaig, Nova Scotia [with French abs.]: Canada Geol. Survey Bull. 165, p. 1–31, illus., tables, 1968.

Silurian conodonts from the Stonehouse Formation, Arisaig, Nova Scotia, include species reported by Walliser from the *eosteinhornensis* zone of the Carnic Alps, in Austria. These are: *Ligonodina elegans* Walliser, *Lonchodina detorta* Walliser, *Lonchodina greilingi* Walliser, *Lonchodina* sp. indet., *Ozarkodina typica denckmanni* Ziegler, *Ozarkodina* cf. *O. jaegeri* Walliser, *Spathognathodus steinhornensis eosteinhornensis* Walliser, and *Trichonodella inconstans* Walliser. In addition, two new species of *Neoprioniodus* are present, as well as fish fragments [including *Cheiracanthoides stonehousensis* n.sp.].—Author's abstract

Legeros, John P. *See* Legeros, Racquel Z. 06377

06377 **Legeros, Racquel Z.; Trautz, Otto R.; Legeros, John P.; Klein, Edward.** Carbonate substitution in the apatite structure—[Pt.] 1, *in* Colloque international sur les phosphates minéraux solides, Toulouse, 1967—V. 1, Structure et propriétés des phosphates: Paris, Soc. Chim. France, p. 66–72, illus., discussion, 1968.

Carbonate can be a substituent in the apatite structure. In carbonate-containing precipitated apatites, the carbonate substitutes for the phosphate groups and not for the hydroxyl groups. The presence of carbonate disturbs the crystallization of apatite and limits the size of its crystals; it also affects the morphology of the forming apatite crystallites. Since in general, crystals grow faster in directions in which strong bonds are forming, the effect of the carbonate on the size and shape of the apatite crystals is considered a consequence of weakening of bonds in the apatite structure caused by the carbonate. This weakening also helps to explain the increased chemical reactivity and dissolution rate reported for biological apatites and carbonate-containing mineral apatites.—*from* Authors' conclusions

06379 **Lehr, J. R.; McClellan, G. H.; Smith, J. P.; Frazier, A. W.** Characterization of apatites in commercial phosphate rocks, *in* Colloque international sur les phosphates minéraux solides, Toulouse, 1967—V. 2, Phosphates naturals-phosphates dans l'agriculture: Paris, Soc. Chim. France, p. 29–44, illus., tables, 1968.

The principal phosphate mineral in commercial phosphate rocks is apatite, varying widely in its properties. Results of examinations of apatite from 107 phosphate rocks representing most of the known commercial deposits are presented. To correlate their crystallographic properties with their chemical compositions and reactivities, X-ray powder diffraction, petrographic and electron microscopy, and infrared spectroscopy were used. Unit-cell contents and thermal stability of carbonate apatites are discussed also. Apatite concentrates from phosphate rocks, and the crystal chemistry of carbonate apatite concentrates are tabulated.—ESL

06663 **Leighty, R. D.** Remote sensing for engineering investigation of terrain—Radar systems, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 669–685, illus., 1968.

This paper discusses the present and future potential of radar for engineering investigation of terrain. The purpose is to acquaint the engineer with the applicable

radar literature pertaining to radar uses, radar systems, radar theory and empirical measurements, qualitative analysis of radar imagery and miscellaneous radar technique.—Author's abstract

Lemish, John. *See* Elwell, James H. 06640

00360 **LeMone, David V.** The Canadian El Paso Group, southern Franklin Mountains, El Paso County, Texas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 16–17, 1969; Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 208–209, 1969.

Lespérance, Pierre J. *See* Ayrton, William G. 00625

00390 **Levin, Franklyn.** Oil exploration technology: Sci. and Technology, no. 86, p. 14–25, illus., 1969.

While the Earth's oil reserves are not likely to run dry in the next several decades, man is forced to explore less accessible regions to find them. Wells sunk to 4-mi depths are not uncommon now; offshore wells are getting deeper and further from land. Of all the earth-probing methods available to the geophysicist, only the seismic method penetrates deep enough while retaining acceptable resolution of the formations being explored. To sound out the Earth is relatively fast and simple; making something of the data is not. Time delays, amplitude variance, and noise can convert theoretically distinctive echoes into an agglomerate hash. The big job is to weed out real signals, shift them into true perspective, and decide if the elements of the picture are those associated with oil-bearing strata.—*from* Author's summary

Lewis, Anthony J. *See* MacDonald, Harold C. 00524

Lewis, C. L. *See* Sine, N. M. 00585

00521 **Lidiak, Edward G.** Buried Precambrian rocks of Nebraska [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 17, 1969.

00522 **Lidiak, Edward G.; Denison, Rodger E.** Buried Precambrian rocks of eastern Kansas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 17–18, 1969.

06521 **Lillegraven, Jason Arthur.** The latest Cretaceous mammals of the upper part of the Edmonton Formation of Alberta, Canada, and a review of the marsupial-placental dichotomy in mammalian evolution [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2241B–2242B, 1968.

06592 **Lindsay, John F.** The development of clast fabric in mudflows: Jour. Sed. Petrology, v. 38, no. 4, p. 1242–1253, illus., 1968.

Mudflow deposits in Permian rocks in Antarctica are used as examples to demonstrate that a computer model will differentiate these from other diamictites. Four A-axis fabrics were measured from the mudflow units and were found to be similar to long-axis fabrics produced by simulations. When compared with till fabrics from the same section the mudflow fabrics can be distinguished because of the presence of dipping girdles in the latter. Had the mudflows been arrested at a stage of maximum fabric development, it would be impossible to distinguish them from most till fabrics. C-axis fabrics developed in mudflows have vertical modes while their counterparts in till fabrics plunge steeply in a downstream direction.—*from* Author's abstract

00377 **Lloyd, R. Michael.** A paleoecological interpretation of the Caloosahatchee Formation, using stable isotopes: Jour. Geology, v. 77, no. 1, p. 1–25, illus., tables, 1969.

Oxygen and carbon isotope analyses of four pelecypod species from the Pleistocene Caloosahatchee Formation of south Florida, coupled with the knowledge of the ecological habitats of the species, are the basis for detailed paleoecologic and

paleogeographic interpretations. The Caloosahatchee was deposited in very shallow restricted marine water that varied from brackish to hypersaline having δO^{18} composition, with variations suggesting paleotopographic highs of Miocene-age rocks. Large variations in carbon isotope data indicate carbon was derived from varied sources during shell growth.—*from* Author's abstract

06644 **Lohnes, R. A.; Joshi, R. C.** Quantitative variations in loess topography: Iowa Acad. Sci. Proc. 1967, v. 74, p. 160–167, illus., 1968.

Morphometric studies of the loess-mantled and loess-depositional topographies of the Wisconsin age loess of western Iowa show that slope angle and absolute drainage density decrease with increasing distance from the Missouri River as a power function. The rate of decrease of both parameters is great for the first eight miles from the river and less for the next 24 miles; it is suggested that the transition in rate be used as a quantitative criterion for the boundary between the two topographies. Loess thickness can be estimated from measurement of slope angle and absolute drainage density; measurements of this type may provide a remote sensing technique for quantitative evaluation of other loess properties.—*from* Authors' abstract

06503 **Loney, Robert A.** Flow structure and composition of the Southern Coulee, Mono Craters, California—A pumiceous rhyolite flow, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 415–440, illus., table, 1968.

Southern Coulee is the southernmost, largest, and one of the youngest of four Recent pumiceous rhyolitic flows of Mono Craters. The coulee, 3.6 km long, 1.2 km wide, and 75 m thick, protruded from a north-trending fissure beneath the crest of Mono Craters ridge. It has three parts: the dome over the orifice where flow was about vertical; the flow, where movement was lateral; and the talus slope surrounding the coulee and formed from the advancing steep-flow front. Three distinctive lithologic units, based on rock density related to degree of vesicularity, have been mapped; contacts between units are abrupt. Rocks characteristic of all units erupted from the southern part of the fissure while only rocks of highest density erupted from the northern part. Petrographic and chemical data indicate a uniform composition for the lava.—*from* Author's abstract

Louapre, M. E. *See* Ewen, H. I. 06394

06395 **Louapre, Merlin E.** Phased arrays for spaceborne microwave sensors, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 59–68, illus., 1968.

Because the two-dimensional phased array antenna is a device of high beam efficiency and volumetric compactness it is ideally suited for use in spaceborne and airborne microwave radiometric sensor systems. This paper describes the development of both electronically-scanned and fixed, multiple beam phased arrays. A brief discussion of array theory as it applies to the problem is presented. Emphasis, however, is given to the practical aspects of achieving the high beam efficiency required in radiometric applications and a discussion of the performance that is attainable.—Author's abstract

06397 **Lowe, D. S.** Line scan devices and why use them, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 77–101, illus., 1968.

This paper discusses the technological development of airborne or spaceborne optical/mechanical scanners, of which the infrared scanner is perhaps the best known member, shows the relationship between scanner performance and component specifications, and discusses modifications for converting the conventional scanner into a quantitative research tool for earth resource applications involving thermal mapping and observation of temperature changes with time. Imagery made with the University of Michigan M-5 infrared scanner is illustrated.—GWL

Lowe, D. S. *See* Horvath, R. 06404

Lundien, J. R. *See* Moore, R. K. 06387

Lunking, W. *See* Dickas, A. B. 06614

Luthin, James N. *See* Taylor, George S. 00492

06577 **Lydon, Philip A.** Geology and lahars of the Tuscan Formation, northern California, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 441–475, illus., 1968.

Lahars of the Tuscan Formation, flowing southwestward from their source in the southernmost Cascade Range, covered almost 2,000 sq mi for a maximum exposed thickness of 1,700 feet. Breccia blocks and lapilli are composed chiefly of andesite and basaltic andesite. The Nomlaki Tuff Member is a distinctive unit within the Tuscan Formation and is one of several tuffs for which different sources can be inferred; correlations with the Nomlaki Tuff should be made with caution. Lahars were emplaced in less than a million years; radiometric and fossil data support a late Pliocene age. Principal source areas were two volcanoes, Mount Maidu and Mount Yana. Sufficient water for creating lahars was probably available from magmatic and meteoric sources. They originated partly by autobrecciation in dikes and conduits at 340° to 280°C.—*from* Author's conclusions

00523 **Lyons, Paul L.** Lateral faulting in midcontinent from geophysical data [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 18, 1969.

MacDonald, Frank H. *See* Key, Charles R. 06718

06501 **Macdonald, Gordon A.** Composition and origin of Hawaiian lavas, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 477–522, illus., tables, 1968.

Hawaiian petrology is discussed against the background of new chemical analyses for major elements in 76 rocks (presented here), the total number of modern analyses, and available trace-element analyses. The three major rocks suites—tholeiitic, alkalic, and nephelinic—are chemically intergradational. The main mass of volcanoes is tholeiitic, followed by a small volume of alkalic lavas; the two types are interbedded in a thin transitional zone. Nephelinic lavas are separated from the others by a long time interval of profound erosional unconformity. Variations within suites are largely the result of crystal differentiation; all three probably are derived from a single type of parent magma of olivine tholeiite composition.—*from* Author's abstract

00453 **MacDonald, Harold C.** Remote sensing techniques in petroleum exploration [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 216, 1969.

00524 **MacDonald, Harold C.; Lewis, Anthony J.** Applications of radar imagery in geologic and geomorphic reconnaissance of tropical environments [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 18–19, 1969.

MacDonald, Harold C. *See* Dellwig, Louis Field. 06386

Macdonald, R. *See* Bailey, D. K. 00476

Mackie, P. E. *See* Young, R. A. 06375

06685 **MacQuown, W. C., Jr.** Geologic map of the Nicholasville quadrangle, Jessamine and Fayette Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-767, scale 1:24,000, section, text, 1968.

Mineral resources of the Nicholasville quadrangle are: limestone, formerly quarried for local use; clays for brick making; traces of fluorite; thin, discontinuous veins of barite; and iron in low concentration and of doubtful commercial value. Farm ponds have been most successfully located on argillaceous limestone and shale which

weather to clay soils impervious to seepage. Oil and gas possibilities are relatively untested. Soils and alluvium pose few problems for civil engineering projects such as road building and foundation work, but consideration should be given to location of faults and sinkholes.—MCM

06661 **Maiklem, W. R.** Some hydraulic properties of bioclastic carbonate grains: Sedimentology, v. 10, no. 2, p. 101–109, illus., 1968.

Settling velocities of bioclastic carbonate grains divided into shape groups—blocks, rods, spheres, and plates—have been compared to calculated settling velocities of calcite and aragonite. Calculated velocities are up to four times greater than actual velocities. Block-shaped grains show the least differences; calculated velocities are as much as half greater for fine to medium sand grains but the same for gravel. Plate-shaped grains have the largest differences, calculated velocities being from about twice greater for sand and about four times greater for pebbles. The differences in settling velocity can be accounted for by shape, bulk density, and settling motion. Settling motion, in turn, is related to shape.—*from* Author's summary

Mailloux, R. *See* Ewen, H. I. 06394

Major, Maurice W. *See* Romig, Phillip R. 06633

00570 **Malahoff, A.; Erickson, B.** A crustal study of the Aleutian Trench [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 58, 1969.

Mallon, K. H. *See* Bingler, E. C. 06715

Mallon, K. H. *See* Bingler, E. C. 06716

00525 **Manes, Monna; Shaffer, Bernard.** Palynological analysis of Cretaceous fecal pellets [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 19, 1969.

Manning, P. G. *See* Faye, G. H. 06769

Manuel, O. K. *See* Alexander, E. G., Jr. 00562

Marangunic, Cedomir. *See* Bull, Colin. 06472

06479 **Marangunic, Cedomir; Bull, Colin.** The landslide on the Sherman Glacier, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 383–394, illus., 1968.

The earthquake of 1964 released several landslides on the Sherman Glacier in the Chugach Mts. 35 km northeast of Cordova. The largest slide covered 8.5 km^2 of the ablation area of the glacier and one of its tributaries. The generation of the slide was favored by the presence of steeply dipping, weak, slightly metamorphosed argillite, overlain almost conformably by massive graywacke and quartzite, with a probable thrust fault along the contact of the two units where the slide scar developed. The debris, spread out as a uniform sheet averaging 1.3 m in thickness, overlies undisturbed 1963–64 snow and reflects preslide topography of the glacier surface. These characteristics and such evidence as the morphological character of the slide indicate it traveled on an air cushion.—*from* Authors' abstract

Marble, Duane F. *See* Alexander, Robert H. 06382

00526 **Marcher, Melvin V.** Ground-water reconnaissance of the Metlakatla Peninsula, Annette Island, Alaska [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 20, 1969.

06474 **Marcus, Melvin G.** Effects on glacier-dammed lakes in the Chugach and Kenai Mountains, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 329–347, illus., tables, 1968.

Because of their ephemeral nature, glacier-dammed lakes might be expected to respond significantly to disturbance of great magnitude, such as the 1964 earthquake. Interpretation of photographs, maps, hydrological records, and reports for ice dammed lakes in the earthquake zone indicates that the shock did not appreciably influence the lakes. Minor effects—localized avalanches, collapsing portions of ice fronts, and disturbed shorelines—were identified, but no major morphological changes occurred, and none of the lakes drained catastrophically during or immediately after the tremor. This lack of response accords with present knowledge of ice-dammed lakes and hypotheses regarding their origin and drainage mechanics.—*from* Author's abstract

06736 **Marlowe, James I.** Unconsolidated marine sediments in Baffin Bay: Jour. Sed. Petrology, v. 38, no. 4, p. 1065–1078, illus., table, 1968.

Baffin Bay sediments are predominantly mud, with minor amounts of sand and gravel. Median grain sizes are related to bottom topography, being coarsest over topographic highs and finer in the central basin. Some sorting is accomplished by the Baffin Land Current. Ice-rafting of pebbles is recognized. Sediment texture is generally coarser with depth, indicating a decrease in current competence with time, and is in accord with the postglacial sea-level rise in the area. Sand occurs in cores from the deepest part of the bay. Downslope-moving bottom currents or suspended-flow phenomena are cited as the transporting agent. Much of the sand is composed of mud aggregates, however, and it appears that the beds containing these features were deposited as "fluxoturbidites" or submarine slumps.—*from* Author's abstract

06742 **Marsh, William W., Jr.; Myers, George, Jr.** Arsenazo III as a metallochromic indicator for the direct DTPA titration of lanthanons in alumino-silicate zeolites: Anal. Chim. Acta, v. 43, no. 3, p. 511–514, tables, 1968.

Arsenazo III has served previously as a metallochromic indicator only in EDTA titration of micro amounts of scandium (III). This paper describes its use with diethylenetriminepentacetic acid (DTPA). The method offers advantages over commonly used indicators: sulfosalicylic acid masks aluminum (III) and iron (III) which do not have to be removed, and large amounts of sulfate can be tolerated.—ESL

Martin, Larry D. *See* Tate, James, Jr. 00513

00511 **Martin, Wayne D.; Henniger, Bernard R.** Mather and Hockingport Sandstone Lentils (Pennsylvanian and Permian) of Dunkard basin, Pennsylvania, West Virginia, and Ohio: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 279–298, illus., 1969.

According to the authors, two isolated, elongate, belt-type sandstone deposits of fluvial origin occur about 70 miles apart in the lower member of the Waynesburg Formation (Pennsylvanian and Permian) in the Dunkard basin. On the belief that these areally extensive bodies are lens wedging out in all directions, they propose the name "Mather Sandstone Lentil" for the body east of Waynesburg, Pa., on the northeast side of the basin, and "Hockingport Sandstone Lentil" for the body west of Hockingport, Ohio, on the southwest side of the basin. The Mather body consists mainly of coarse-grained sandstone, the Hockingport body of coarse to very coarse sand with pods of conglomerate. On the basis of similarity in composition, the authors believe the detritus was derived from essentially the same source.—BHK

00445 **Martin, William B.** Preliminary observations of potshot geologic effects of Gasbuggy nuclear stimulation experiment, northeastern San Juan basin, New Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 213, 1969.

Masenthin, H. W. *See* Moore, R. K. 06387

Masse, R. *See* Landisman, M. 06651

Matsumoto, H. *See* Forbes, Robert B. 00614

Matten, Lawrence C. *See* Sebby, Wade S. 00519

06724 **Matthews, R. K.** Carbonate diagenesis—Equilibration of sedimentary mineralogy to the subaerial environment; coral cap of Barbados, West Indies: Jour. Sed. Petrology, v. 38, no. 4, p. 1110–1119, illus., 1968.

The youngest terrace on the island (82,000 B.P.) is composed of generally unstable mineralogy, terraces older than 500,000 years of stable, and terraces of intermediate age of both. Different portions of Barbados have decidedly different climates. Thus reef tracts of equivalent age can be studied in a high-rainfall, low-evaporation terrain and in a low-rainfall, high-evaporation terrain. Mineralogical stabilization proceeds more slowly in the drier climates. A model is proposed for the stabilization process at or near the outcropping surface of an aragonite–calcite sediment. The kinetics of calcite nucleation and of crystal growth, and the availability and transport of water can each be the "rate step" in geologically realistic situations. The model is extended to include mineralogical stabilization in subsurface meteoric water. *from* Author's abstract

Mattinson, James M. *See* Fisher, Richard V. 06688

Mayewski, Paul A. *See* Hodge, Dennis S. 00557

Mazor, Emanuel. *See* Heymann, Dieter. 06677

00620 **McCammon, Helen M.; Auld, Judith A.; Watson, Joseph A.** Adsorption of iron to the shells of brachiopods: Geol. Soc. America Bull., v. 80, no. 3, p. 527–530, illus., 1969.

The studies of the adsorption of iron on the shells of the brachiopod *Waltonia inconspicua* have shown the following: (1) A rapid uptake of iron by the skeletal parts occurs during the first few hours following exposure. (2) The level of iron adsorbed is proportional to the concentration of the element in solution except at 1×10^{-3} M, the highest concentration studied. (3) The adsorption of iron is greater from sea water than from distilled water, except at a 1×10^{-3} M concentration. (4) Most of the adsorbed iron is retained by the skeletal material.—HCR

00464 **McCasland, Barney C.** Permian basin sulfur, Texas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 219, 1969.

McClellan, G. H. *See* Lehr, J. R. 06379

00547 **McConnell, Duncan.** Discovery of the garnet, khoharite? [Discussion of paper by B. Mason, J. Nelen, J. S. White, Jr., 1968]: Science, v. 163, no. 3869, p. 828–829, 1969.

The composition of the garnet found in the Coorara chondrite, as reported by Mason, Nelen, and White (ibid., v. 160, no. 3823, p. 66–67, 1968) fails to conform to the theoretical requirements for a garnet structure. Did they discover a complex isomorphic variant of khoharite, and if so, what is its true composition?—DBV

06652 **McConnell, Robert K., Jr.** Recent evidence for the anelastic properties of the upper mantle in periods in the range 10^3 to 10^5 seconds [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 9–10, 1968.

06366 **McCrone, Alistair W.; Koch, Robert C.** Some geochemical properties of Hudson River sediments—Kingston to Manhattan, *in* Hudson River ecology—Symposium, 1966, Tuxedo, N.Y.: [Albany] Hudson River Valley Comm. New York, p. 41–59, illus., tables [1968?].

Samples, 15 in all, were taken about 5–10 miles apart from Kingston, N.Y., from above the Hudson estuary, to the river mouth. The samples were analyzed with a view toward determining their capacity to absorb chemical pollutants. The muds are known to have substantial cation exchange capacities, yet are very low in their

content of some of the common cations. It is shown that the muds are not able to accept more than minor amounts of sodium so that excessive sodium pollution dumped into the river would remain in the water and affect the nutrient ecology substantially; the muds cannot help purify the river by absorbing sodium.—HRC

06491 **McCulloch, David S.** Slide-induced waves, seiching, and ground fracturing at Kenai Lake, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 47–81, illus., table, reprinted 1968; originally published 1966.

This paper is reprinted with minor changes from U.S. Geol. Survey Prof. Paper 543-A, 1966. *See* Abstracts of North American Geology for December 1966. MCM

06536 **McEwen, Robert Barlow.** Orbital photogrammetry—A theoretical study of auxiliary data application [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2032B, 1968.

06467 **McGarr, Arthur.** Excitation of seiches in channels by seismic waves, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 133–139, illus.; reprinted 1968; originally published 1965.

This paper is reprinted with minor changes from Jour. Geophys. Research, v. 70, no. 4, p. 847–854, 1965.—MCM

06639 **McGarr, Arthur.** Amplitude variations of Rayleigh waves—Horizontal refraction [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 21, 1968.

00527 **McGinnis, L. D.** Mascons and crustal bending in the continental interior [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 20, 1969.

00456 **McGregor, Alexander A.; Biggs, Charles A.** Bell Creek field—A rich stratigraphic trap, Powder River and Carter Counties, Montana [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 217, 1969.

00601 **McGuinness, C. L.** New thrusts in ground water: Water Well Jour., v. 23, no. 2, p. 22–24, 1969.

Ground-water withdrawal doubled from 1950 to 1965 from about 30 to about 60 bgd. Aquifers will continue to increase as a source, surface water growing more expensive so that aquifers will be used more for storage of floodwater. Uses of ground-water reservoirs for a fresh water supply, for fresh-water storage, as a source of saline water for desalination, and for subsurface waste storage are discussed. The big problem is gathering sufficient information.—ESL

00483 **McKee, Edwin H.; Ross, Reuben J., Jr.** Stratigraphy of eastern assemblage rocks in a window in Roberts Mountains thrust, northern Toquima Range, central Nevada: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 421–429, illus., 1969.

Ordovician and Silurian rocks of the carbonate (eastern) assemblage are exposed in a window in Ordovician rocks of the siliceous and volcanic (western) assemblage of the northern part of the Toquima Range, central Nevada. The window exposes rock beneath part of the Roberts Mountains thrust, and covers an area of approximately 20 sq mi. The strata within the window resemble, and are correlated with, rocks exposed farther south in the central part of the Toquima Range and on the east in the Antelope Valley region.—Authors' abstract

McKee, Edwin H. *See* Robinson, Paul T. 06578

00455 **McKenny, Jere W.** Oil and gas on Toadlena anticline, Arizona and New Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 217, 1969.

McKown, D. M. *See* Ehmann, W. D. 00520

06618 **McLean, J. Ross.** Bedform migration, Pinnacle–Long Island Flats, Minas Basin, Nova Scotia [abs.]: Maritime Sediments, v. 4, no. 2, p. 54, 1968.

06517 **McLean, Willis John.** The crystal structures of the tetrahydrates of tetramethylammonium fluoride and tetramethylammonium sulfate, a refinement of the crystal structure of enargite and the crystal structure of hemihedrite [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2139B, 1968.

McNeill, J. D. *See* Barringer, A. R. 06400

Melancon, Paul E. *See* Kelley, Vincent C. 00441

Melson, W. G. *See* Thompson, Geoffrey. 06600

00528 **Menzer, Fred J.** Petrography and petrogenesis of sillimanite zone, almandine-amphibolite facies schists and gneisses south of Conconully, north-central Washington State [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 21, 1969.

00571 **Mercado, Sergio.** Cerro Prieto geothermal field, Baja California, Mexico [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 59, 1969.

06766 **Merkle, A. B.; Slaughter, M.** Determination and refinement of the structure of heulandite: Am. Mineralogist, v. 53, nos. 7–8, p. 1120–1138, illus., tables, 1968.

Heulandite is monoclinic, Cm, with unit cell $a=17.73$, $b=17.82$, $c=7.43$ A, $\beta=116°20'$; $Z=4\times[(Ca,Na_2)Al_2Si_7O_{18}\cdot 6H_2O]$. Refinement of the structure of heulandite by the least-squares yields $R=0.14$ and weighted R of 0.11. Heulandite has well-defined layers formed by 6–, 5–, and 4–member tetrahedral rings lying in ac– at 0.25 and 0.75 along b–. Open channels are formed by 10–, and 8–member rings which also lie in ac– at 0.00 and 0.50 along b–. The (010) cleavage is caused by an alternation of the tetrahedral layers and open channels. The structure of heulandite is consistent with Taylor's original concept and with its physical properties.—*from* Authors' abstract

00619 **Merriam, Richard.** Source of sand dunes of southeastern California and northwestern Sonora, Mexico: Geol. Soc. America Bull., v. 80, no. 3, p. 531–533, illus., table, 1969.

Extensive dunes of southwestern California and northwestern Sonora, Mexico, were derived mainly from Cenozoic Colorado River delta sediment. All dune sand and sandy delta sediment have K-feldspar in excess of plagioclase, abundant volcanic fragments, detrital Cretaceous Foraminifera, and abundant detrital calcite and dolomite. Sands derived from local crystalline bedrock and carried by the Whitewater River and major washes entering the Salton Basin lack these features.—Author's abstract

06761 **Merrill, Robert H.** Bureau contribution to slope angle research at the Kimbley Pit, Ely, Nevada: Soc. Mining Engineers Trans., v. 241, no. 4, p. 513–525, illus., 1968.

In a joint research program to determine slope stability at Kennecott Copper Corporation's Kimbley Pit, near Ely, Nev., supporting laboratory investigations were made at the Denver office of the U.S. Bureau of Mines. Following determination of rock stress in the mine district, strike and dip of geologic defects in the rock, and experimental tests of its strength, a new slope angle and pit configuration were selected. Instruments were installed to measure changes in stress, strain displacement, microseismic noise rate, and sonic velocities at several points in the west wall. The new slope angle started at 45° on the south wall gradually increased to 57 1/2° at center of west wall, and to 61° on the north wall. The pit was deepened from 500 to 550 feet. In a year and a half, measurements showed the pit wall stable at the start, changed during excavation, then returned to a condition of equilibrium.—GDC

06553 **Meyer, Richard Fastabend.** Geology of Pennsylvanian and Wolfcampian rocks in southeastern New Mexico [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2088B–2089B, 1968.

00452 **Meyerhoff, A. A.** Spreading sea floor—By convection or conviction? [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 215–216, 1969.

00440 **Meyerhoff, Howard A.** Competitive position of energy resources in Rocky Mountain region [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 211–212, 1969.

06554 **Mikesh, David Leonard.** Permian goniatitid ammonoids—Family Paragastrioceratidae [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2089B, 1968.

06760 **Miller, Halsey W.** Additions to the Upper Cretaceous vertebrate fauna of Phoebus Landing, North Carolina: Elisha Mitchell Sci. Soc. Jour., v. 84, no. 4, p. 467–471, illus., 1968.

Additional teeth and bones of fresh water and marine fish are described from a channel sandstone cut into the Upper Cretaceous Black Creek Formation. The specimens suggest an estuarine or tidal environment. The fresh water fishes are amiids, possibly a large and a small species, and the marine fishes include a hybodont shark, a ray, a pycnodont, and a chimaeroid. Phoebus Landing is on the Cape Fear River near Elizabethtown, N.C.—HRC

06555 **Milling, Marcus Eugene.** Petrology and petrography of glacial tills and their weathering profiles in southeastern Iowa [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2090B, 1968.

Mills, W. R., Jr. *See* Givens, W. W. 06515

06660 **Minato, Masao; Rowett, Charles L.** Modes of reproduction in rugose corals: Lethaia, v. 1, no. 2, p. 175–183, illus., 1968.

It is postulated that compound and at least some so-called solitary forms of fossil rugose corals had alternating sexual and asexual reproduction. Although only asexual reproduction is evident in compound forms, the origin of the initial corallite of a compound corallum is best explained by sexual reproduction. In most non-colonial or 'solitary' species, reproduction is presumed to be entirely sexual; however, simple budding has been observed in three species, indicating a repressed asexual generation. The term 'solitary' should be restricted to single corallites showing no evidence of budding. *Timania rainbowensis* Rowett (1968, in press) from the lower Permian of east-central Alaska, and two species from the Pennsylvanian and Permian of Japan must be described as including both solitary and simple budding individuals.—VMJ

Mindak, H. E. *See* Fremlin, G. 06707

06392 **Mintzer, O. W.** Remote sensing for engineering investigation of terrain photographic systems, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 687–699, illus., 1968.

The history, application, and principles of aerial panchromatic, color and false-color photography, and geophysical survey data for terrain investigation are discussed. The potential value of multispectral, radar, and infrared imagery and combinations of sensors of soil investigations are considered.—GWL

00469 **Misch, Peter.** Paracrystalline microboudinage of zoned grains and other criteria for synkinematic growth of metamorphic minerals: Am. Jour. Sci., v. 267, no. 1, p. 43–63, illus., 1969.

Recrystallization synchronous with elongation parallel to the schistosity is demonstrated by microboundinage of complexly-zoned Na-amphiboles in the

Shuksan Greenschist (northern Cascades, Washington). Microboudinage of rigid lenticles and epidote grains is postcrystalline in respect to epidote but paracrystalline in respect to schistose matrix that flowed into gaps and to mineral precipitation in the gaps. Paracrystalline microfolding is demonstrated by polygonal arcs composed of crystals still weakly bent on the same fold patterns. A Shuksan crossite schist displays recrystallization controlled by pressure gradients operative during microfolding, with transfer of chlorite and muscovite from the limbs into the hinges, resulting in incipient secondary compositional layering parallel to the axial plane.—*from* Author's abstract

Misch, Peter. *See* Babcock, Randall S. 00580

00430 **Mitchum, Robert N.; Bubb, John N.; Perry, Douglas.** Authigenic and detrital dolomite in unconsolidated deep-water sediments of West Florida slope, Gulf of Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 206–207, 1969.

06605 **Modarresi, Hassan G.** Settling velocity tube apparatus for successive determination of fall velocities of sand size particles: Jour. Sed. Petrology, v. 38, no. 4, p. 1354–1358, illus., 1968.

Conventional sedimentation methods are impractical for determining settling velocity distribution of a sand sample limited to a few hundred grains. The settling velocity distribution of a very small amount of sand grains may be determined accurately in a one step operation using a modified Hand settling tube and an electrical event recorder.—Author's abstract

Moiola, Richard J. *See* Robinson, Paul T. 06578

Monroe, Watson H. *See* Ross, Clarence S. 06597

Monroe, William A. *See* Todd, Thomas W. 06737

Montgomery, Arthur. *See* Frondel, Clifford. 06773

Moore, Clyde H., Jr. *See* Blount, Don N. 00624

Moore, Eric G. *See* Alexander, Robert H. 06382

Moore, P. B. *See* Birle, J. D. 06460

06466 **Moore, Paul B.** Crystal chemistry of the basic manganese arsenate minerals—[Pt.] 2, The crystal structure of allactite: Am. Mineralogist, v. 53, nos. 5–6, p. 733–741, illus., tables, 1968.

Allactite, $Mn_7(OH)_8(AsO_4)_2$, with a = 11.0,, b = 12.12, c = 5.51 A, β = 114°04′, Z = 2, $P2_1/a$, solved by vector sets applied to P(xy) and P(xz), is a complicated structure. Its principal features are bands of octahedra, two octahedra wide, held together by vertex-linked octahedra, forming flat sheets parallel *a*[100]. The sheets are in turn held together by chains of linked Mn(2)–O octahedra and As–O tetrahedra running parallel *b*[010]. The bridging Mn(2)–O octahedra connect to the sheets in a complicated fashion, exhibiting corner-, edge-, and face-sharing with them. The octahedral bands are strips of the pyrochroite structure and it is suggested that this may be a dominant feature of other basic manganese arsenates as well.—*from* Author's abstract

06740 **Moore, Paul B.** The crystal structure of chlorophoenicite: Am. Mineralogist, v. 53, nos. 7–8, p. 1110–1119, illus., tables, 1968.

Chlorophoenicite, $(Mn,Mg)_3Zn_2(OH)_6[As_{0.5},H_{0.5}](O,OH)_3]_2$, a=22.98, b=3.32, c=7.32 A, β=106°0′, Z=2, C2/m, was solved by vector sets applied to P(uw). The final Rh01, hk0=0.122 for 330 independent reflections. The principal structural features are infinite insular slabs of the formula units parallel to *a*. Slabs are hydrogen bonded to each other only and perfect *a* cleavage is observed. The slabs are in turn made up of Mn–(O,OH) octahedral pyrochroite fragments or bands three

octahedra wide running parallel to *b*, connected along *c* by $[(As_{0.5}, H_{0.5})(O,OH)_3]$ and $[Zn(O,OH)_3]$ tetrahedral chains which also run parallel to *b*.—*from* Author's abstract

06775 **Moore, Paul B.** Substitutions of the type $(Sb_{0.5}^{5+} Fe_{0.5}^{3+}) \rightleftharpoons (Ti^{4+})$—The crystal structure of melanostibite: Am. Mineralogist, v. 53, nos. 7–8, p. 1104–1109, illus., tables, 1968.

Melanostibite, $Mn^{2+}(Sb_{0.5}^{5+} Fe_{0.5}^{3+})O_3$, is shown to be fully disordered and isostructural with members of the ilmenite–pyrophanite group on the basis of three-dimensional crystal structure analysis. Pertinent cell data are $a_{hex} = 5.226$ A, $c_{hex} = 14.325$ A, R3, $Z = 6$. Atom coordinates are (6)Mn:O,O,0.1378±.0002; (6)(Sb Fe):O,O, 0.3473±0.0001; and (18) O, 0.2873±0.0016, –0.0252±0.0016, 0.2559±0.0005. Sb^{5+}, if present in ilmenite- or rutile-bearing ores, may be concealed by the coupled substitution $(Sb_{0.5}^{5+} Fe_{0.5}^{3+}) \rightleftharpoons (Ti^{4+})$.—Author's abstract

06779 **Moore, Paul B.** Relation of the manganese-calcium silicates, gageite and harstigite—A correction: Am. Mineralogist, v. 53, nos. 7–8, p. 1418–1420, tables, 1968.

A revised formula is given for harstigite and it is concluded that the mineral is closely related but distinct from aminoffite. The relation between harstigite and gageite proposed earlier (ibid., v. 53, p. 309–315, 1968) is examined; the crystal structure of gageite is now known and there appears to be no relation to harstigite. It is proposed that harstigite be classified with aminoffite under the melitite group and related structures.—VSN

00529 **Moore, R. C.; Strimple, Harrell L.** Explosive evolutionary differentiation of unique group of Mississippian–Pennsylvanian camerate crinoids (Acrocrinidae) [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 21–22, 1969.

06387 **Moore, R. K.; Waite, W. P.; Lundien, J. R.; Masenthin, H. W.** Radar scatterometer data analysis techniques, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 765–780, illus., tables, 1968.

The use of scatterometry for discrimination and identification of terrain surfaces requires the simultaneous scanning of multiple parameter data at a much faster rate than can be achieved with the normal scattering coefficient versus angle of incidence curves. Data for Pisgah Crater, California, are analyzed using color combination techniques, clustering techniques, principal components analysis, and adaptive pattern recognition techniques.—GWL

00530 **Morency, Maurice; Emond, Pierre.** Investigation of the radiation history of upper Devonian and Pennsylvanian conodonts by electron spin resonance [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 22, 1969.

Morris, Hal T. *See* Radtke, Arthur S. 00605

Morris, R. L. *See* Tixier, M. P. 06513

06658 **Morris, W. V.** Water: Ottawa, Canada Dept. Energy, Mines and Resources, Inland Waters Br., 61 p., illus., 1968.

Considered here are: the vital role of water in sustaining life and the relationship between water supply and standard of living; origin of the world's water, formation of salt oceans, and importance of the comparatively small quantity of fresh water moving through the hydrologic cycle; where and in what form fresh water is found; Canada's share of the world's supply and its importance to Canadian economy; the problems of floods, water shortages, and pollution; how conflicting demands for water complicate development and conservation; and integrated administrative responsibility.—GDC

Morrison, Jack L. *See* Blackwell, Phillip W. 00593

Mose, D. G. *See* Bickford, M. E. 00421

00531 **Mose, Douglas.** The age of the Hatton tuff, Ouachita Mountains, Oklahoma [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 22, 1969.

Moss, George J., Jr. *See* Key, Charles R. 06718

06619 **Mrakovich, John V.** A study of cross-stratification and grain-size analysis on West Bar, Economy Point [abs.]: Maritime Sediments, v. 4, no. 2, p. 54–55, 1968.

Mueller, Leslie C. *See* Goebel, Edwin D. 06373

00477 **Muffler, L. J. Patrick; Short, James M.; Keith, Terry E. C.; Smith, Vertie C.** Chemistry of fresh and altered basaltic glass from the Upper Triassic Hound Island Volcanics, southeastern Alaska: Am. Jour. Sci., v. 267, no. 2, p. 196–209, illus., table, 1969.

Gravimetric chemical analysis confirms that Triassic glass described by Brew and Muffler (1965) is basaltic. SiO_2 is 47.95 percent, total H_2O only 1.58 percent, and $Fe_2O_3/FeO+ Fe_2O_3$ only 0.065. This glass occurs as green fragments cemented by calcite in an aquagene tuff within the Hound Island Volcanics. Each fragment is rimmed and veined by brown glass, interpreted texturally as an alteration product. Thin bands of crystalline material occur between the hydrated brown glass and the calcite matrix; the inner of these bands contains abundant mordenite, and the outer band is primarily K-feldspar and chlorite. Chemical and normative data on basalts containing appreciable hydrated or devitrified glass should be suspect.—*from* Authors' abstract

06383 **Muir, Allan H.; Sattinger, Irvin J.** Methods of feasibility and economic analysis of remote sensing applications, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 927–939, illus., 1968.

To establish technical feasibility, the requirements must be translated into specification of such equipment characteristics as resolution, sensitivity, and spectral discrimination, and such operational characteristics as area coverage and timeliness of the data, as well as the effectiveness of image interpretation and analysis techniques. The economic justification of a specific project can be analyzed by determining the cost-effectiveness ratio. A methodology for computing benefits developed for evaluating space applications of remote sensing is described.—GWL

06586 **Mull, D. S.** (and others). The hydrology of the Lexington and Fayette County, Kentucky area: Lexington, Ky., Lexington and Fayette County Plan. Comm., 24 p., illus., tables, 1968.

The amount and quality of water in streams and aquifers, and water management are discussed for Fayette County. About 582 mgd of water (or 43.71 inches annually) enters Fayette County from precipitation, of which 224 mgd runs off in streams to the Kentucky River, either directly overland or as ground-water flow to springs. Loss of 16 mgd by underflow is due to cavernous bedrock in Ordovician limestones with good interconnection of elongated solution channels. Much water may be discharged into shallow and deep aquifers in the Lexington area through abundant joints and openings; also sewage and storm-water drainage may affect wells and springs at some distance from point of entry. Chemical analyses of surface and ground water are tabulated. Potential deep aquifers are the Knox Dolomite and St. Peter Sandstone.—GDC

00550 **Müller, German.** Sedimentary phosphate method for estimating paleosalinities—Limited applicability: Science, v. 163, no. 3869, p. 812–813, table, 1969.

The sedimentary phosphate method for estimating paleosalinities was tested on argillaceous sediments from different formations and environments. Results reveal that the method cannot be used generally.—Author's abstract

00431 **Munn, James K.** Breedlove field, Martin County, Texas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 207, 1969.

06455 **Murdoch, Joseph; Geissman, Theodore A.** Pendletonite—A correction [to 1967 paper]: Am. Mineralogist, v. 53, nos. 5–6, p. 1061–1062, illus., 1968.

Five corrections are given for data summarized in the abstract and a correct figure is substituted for Figure 2 that was erroneously drawn and indexed in the original text. See ibid., v. 52, p. 611–616, 1967.—VSN

Murphy, William J. *See* Fischer, Joseph A. 06632

Myers, A. T. *See* Solt, M. W. 00518

Myers, George, Jr. *See* Marsh, William W., Jr. 06742

00602 **Nace, Raymond L.** Ground water—Perspectives and prospects: Water Well Jour., v. 23, no. 2, p. 28–29, illus., table, 1969.

Hydrologists are capable of making very realistic estimates of ground-water supplies for the local or regional ground-water system; large-scale total water systems have received too little attention. A tabulation of the estimated isochronous volume of fresh water of the world shows that 96 percent of all fresh water on continents is in aquifers. About 3 percent of the precipitation in the United States is not accounted for by runoff and evaporation. Aquifers may be used for storage without any construction, and 11 other important advantages as storage reservoirs are listed. The great reservoirs of the future are underground and it is time we learned to manage them safely.—ESL

Nassau, K. *See* Wood, D. L. 06456

06459 **Nassau, K.; Wood, D. L.** An examination of red beryl from Utah: Am. Mineralogist, v. 53, nos. 5–6, p. 801–806, illus., table, 1968.

The color of red beryl from Topaz Mountain, Thomas Range, Utah, is due to several absorptions peaking in the 0.48 to 0.55μ region and is probably caused by Mn^{2+}. The lattice constants are a = 9.23627 ± 4 A, c = 9.1972 ± 1 A. The unusual complete absence of water is probably due to growth at a very low pressure and high temperature.—Authors' abstract

06488 **National Research Council.** (Div. Earth Sci., Comm. Alaska Earthquake). The great Alaska earthquake of 1964—Hydrology, Pts. A and B: Natl. Acad. Sci. Pub. 1603, pt. A, 441 p., illus., tables, pt. B, 7 charts, 1968.

The task of the Committee on the Alaskan earthquake of 1964 was to evaluate efforts being made to gather scientific and engineering information about the earthquake and its effects, to encourage the filling of gaps in the record, and to compile and publish a comprehensive report. This report, prepared by the Committee and its seven specialized panels, can be applied toward the preparation for and study of future earthquakes, as well as natural disasters in general. Twenty papers, many of them reprints, are cited separately.—MCM

00623 **Naylor, Richard S.** Age and origin of the Oliverian Domes, central-western New Hampshire: Geol. Soc. America Bull., v. 80, no. 3, p. 405–427, illus., tables, 1969.

New information on the origin of mantled gneiss domes comes from a study of the Oliverian Domes which indicates that the core of the Mascoma Dome can be divided into two units: a gneiss lying stratigraphically beneath the mantling volcanic rocks and a subcentral granitic pluton which crosscuts the gneiss and probably the volcanics. Whole-rock samples of volcanic and granitic rocks yield Rb–Sr ages

of 440 ± 40 m.y. Zircon separates from the gneissic and granitic rocks yield lead ages of 450 ± 25 m.y. The core rock is the result of volcanic and intrusive activity, not the result of post-Lower Devonian remobilization of basement subsequent to deposition of mantling strata.—AG

00383 **Needham, H. D.; Habib, D.; Heezen, B. C.** Upper Carboniferous palynomorphs as a tracer of red sediment dispersal patterns in the northwest Atlantic: Jour. Geology, v. 77, no. 1, p. 113–120, illus., tables, 1969.

The distribution of spores and pollen of Pennsylvanian age define the source rocks and trace the southward transport of red sediment during Pleistocene time from southeastern Canada to the Blake-Bahama Outer Ridge off the coast of Florida. This pre-Wisconsin sediment on the continental rise, which contains the reworked palynomorphs, is interpreted to have been transported by deep currents, and can be related to major and minor climatic fluctuations since at least the beginning of Pleistocene time.—VES

Nelen, Joseph A. *See* Leavens, Peter B. 06770

00508 **Nelson, Robert B.** Relation and history of structures in a sedimentary succession with deeper metamorphic structures, eastern Great Basin: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 307–339, illus., tables, 1969.

Complex tectonic development of the Deep Creek Range, Kern Mountains, and northernmost Snake Range, Nevada-Utah, includes 1) growth of the major north-trending Trout Creek anticline, development of synkinematic metamorphism with east-west trends, east-west folding and thrusting with tectonic thinning, intrusion of lamprophyre sills, and postkinematic crystallization of higher grade minerals, quartz, and intrusion of quartz veins; 2) major east-west folding and formation of minor structures at depth; 3) major eastward movement of the Snake Range decollement across crystalline substrata with attendant faulting and shearing, and intrusion of granitic plutons below the thrust and sheared by it. Events occurred in a thermally continuous sequence; increased crustal rigidity through time is postulated. A cyclic deformational pattern recognized is believed to result from a combination of vertical uplift and lateral compression.—EGS

06396 **Newell, H. E.** Current program and considerations of the future for Earth resources survey, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 69–75, 1968.

This paper summarizes six years of progress in remote sensing studies from satellite, ground, and aircraft in the fields of meteorology, geodesy, oceanography, forestry, agriculture, hydrology, and geology. Current needs and future plans are discussed.—GWL

06378 **Newesely, H.; Paulick, J.; Strunz, H.** La composition topochimique de cristaux d'apatite de Durango, *in* Colloque international sur les phosphates minéraux solides, Toulouse, 1967—V. 2, Phosphates naturels-Phosphates dans l'agriculture: Paris, Soc. Chim. France, p. 25–27, illus., tables, 1968.

Inclusions of foreign material were found in crystals from Cerro de Mercado, Durango, Mexico. Proximity of iron minerals may have acted on growth of apatite crystals and determined micromorphology of crystal faces, confirming that apatite crystals formed during a geologic period characterized by times of dissolution and circulation of mineral matter. The crystals, fluorapatite with partial substitution by hydroxyl and chlorine ions, show an abnormal biaxial birefringence of $2V = 10°$. Spectrographic analysis showed trace elements present, probably residual from inclusions. Prism faces of macroscopic crystals were determined. Major constituents of the phosphatic substance of the apatites have been identified as quartz, calcite, and colorless apatite; X-ray diffraction shows in addition hematite, goethite, and magnetite, and all minerals show traces of dissolution. Growth layers around the foreign material are described.—ESL

00428 **Nichols, Donald R.; Yehle, Lynn A.** Engineering geologic map of the southeastern Copper River basin, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-524, scale 1:125,000, 1969.

This map sheet includes a chart giving descriptions of geologic units and their engineering characteristics, such as: distribution and thickness, terrain and natural slope, drainage and water table, permafrost and frost susceptibility, and suitability for foundations and borrow.—MCM

Nickel, E. H. *See* Faye, G. H. 06769

06701 **Nicoll, Robert S.; Rexroad, Carl B.** Stratigraphy and conodont paleontology of the Salamonie Dolomite and Lee Creek Member of the Brassfield Limestone (Silurian) in southeastern Indiana and adjacent Kentucky: Indiana Geol. Survey Bull. 40, 73 p., illus., 1968.

Zonation established by study of the conodont faunas of the Lee Creek Member of the Brassfield Limestone and of the Salamonie Dolomite, both of Silurian age, from 42 sections in southeastern Indiana and adjacent Kentucky differs from the conodont zonation established by Walliser in 1964 for the Lower Silurian and lower part of the Middle Silurian of the Carnic Alps of Europe. Three conodont assemblage zones are named. The new name Lee Creek Member is applied to a thin dolomite unit at the top of the Brassfield Limestone. Two new genera and 16 new species are identified.—KAF

06556 **Northrop, John.** An investigation of the relation between source characteristics and T phases in the North Pacific Ocean [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2090B-2091B, 1968.

00544 **Oberbeck, V. R.; Quaide, W. L.; Greeley, R.** Collapsed lava tubes, possible analogs of some lunar sinuous rilles [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 58, 1969.

Obradovich, J. D. *See* Robinson, G. D. 06502

Odom, A. L. *See* Anderson, Jay Earl, Jr. 00419

Ojakangas, Richard W. *See* Dickinson, William R. 00618

06635 **Oliver, Jack; Sykes, Lynn; Isacks, Bryan.** Seismology and the new global tectonics [abs.]: Earthquake Notes, v. 39, nos. 3-4, p. 16-17, 1968.

06571 **Ollerenshaw, N. C.** Preliminary account of the geology of Limestone Mountain map-area, southern Foothills, Alberta: Canada Geol. Survey Paper 68-24, 37 p., illus., table, geol. map, 1968.

Marine and nonmarine sediments were deposited in a Middle Cambrian to Late Cretaceous shelf environment; carbonate sequences predominate the Paleozoic, clastics the Mesozoic. Rocks were thrust northeastward along three major faults: McConnell, Burnt Timber and Fallentimber. The northeastern two-thirds of the area lies within the latter thrust sheet, the other two form southwest-dipping homoclinal sequences, the second folded at depth; the mountain front coincides with the McConnell fault's surface trace. The Fallentimber thrust-sheet is divided into the Limestone Mtn. anticlinorium, Bread Creek synclinorium, and Marble Mtn. anticlinorium; fold axes are *en echelon*, profiles generally asymmetrical, and overturned. Splay faults from the Fallentimber thrust cut the folds and are themselves locally folded. Drilling has failed to reveal hydrocarbon traps.—GDC

06725 **Olsson, Ingrid U.** Modern aspects of radiocarbon datings: Earth-Sci. Rev., v. 4, no. 3, p. 203-218, illus., table, 1968.

The radiocarbon method for radioactive-age determination is discussed and recent developments in the fixing of the half-life time of C-14 are reviewed. The occurrence and causes of variations in the C-14/C-12 ratio are outlined, as are the possibilities and influences of contamination. The paper aims to give a wide geological public

an insight into the background, applicability, and reliability of the method.—Author's summary

00627 **Ondrick, C. W.; Griffiths, J. C.** Frequency distribution of elements in Rensselaer Graywacke, Troy, New York: Geol. Soc. America Bull., v. 80, no. 3, p. 509–518, illus., tables, 1969.

Frequency distributions of 11 major/minor oxides and 9 trace elements for 119 samples of Rensselaer Graywacke were tested against both normal and lognormal distribution models. Most distributions failed to follow the models; 9 distributions, however, are similar to the models. The Rensselaer (N.Y.), Franciscan (Calif.), and "average" graywacke (Pettijohn) are enriched in Al_2O_3, total Fe, and Na_2O and have Na_2O/K_2O ratios greater than 1, whereas other similar sedimentary rock types have ratios less than 1. The present investigation agrees with other workers findings that graywackes have Na_2O/K_2O ratios greater than 1, an apparent peculiarity of high-rank graywackes. In chemistry the Rensselaer Graywacke appears to represent closely the composition of the "average" Earth's crust.—EHP

00435 **Opdyke, Neil D.** Paleomagnetic correlation [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 209, 1969.

06611 **Orlansky, Ralph.** Method for making slides of fine-grained unconsolidated sediment and ooze: Jour. Sed. Petrology, v. 38, no. 4, p. 1378, 1968.

Outlined is a simple and rapid method for preparing permanent slides of fine-grained unconsolidated organic or inorganic sediment. Clearcol, water-miscible mountant, is the binder for a thin film of sediment, which is sealed on a glass slide.—Author's abstract

Orville, Philip M. *See* Grover, John E. 00563

06527 **Overton, Harold L.** Formation evaluation in engineering education: Log Analyst, v. 9, no. 2, p. 14–15, 1968.

Formal course categories, applied research, and special laboratories in use for study of formation evaluation at the University of Houston, Houston, Tex., are summarized.—VSN

00578 **Ozard, J. M.** Fractionation of lead isotope ratios [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 62, 1969.

06367 **Panuzio, Frank L.** The Hudson River model, *in* Hudson River ecology—Symposium, 1966, Tuxedo, N.Y.: [Albany] Hudson River Valley Comm. New York, p. 83–113, illus. [1968?].

A model of the Hudson River has been constructed by the Corps of Engineers at Vicksburg, Miss., to investigate heavy shoaling in channels and slips. A general description of the Hudson River basin is followed by a discussion of the flow characteristics of the river, including tidal and other influences. The nature of the sedimentation process in the New York City area is described. The solutions provided are the construction of various sediment basins to trap the shoal material, closure of the Harlem River to prevent salt-water mixing with water of the Hudson, and deepening and widening specific portions of the channel. No economically justifiable plan to reduce shoaling in the slips was determined.—HRC

Papadopulos, Istavros. *See* Cooper, Hilton H., Jr. 06580

Papike, J. J. *See* Clark, Joan R. 06462

06768 **Papike, J. J.; Clark, Joan R.** The crystal structure and cation distribution of glaucophane: Am. Mineralogist, v. 53, nos. 7–8, p. 1156–1173, illus., tables, 1968.

Three-dimensional, scintillation-counter measured, X-ray diffraction data have been used in least-squares refinement of the atomic parameters and cation-site occupancy factors for the crystal-structure of glaucophane from Tiburon Peninsula,

Calif. By assuming that each of the four cation sites in amphiboles is fully occupied by no more than two atomic species, preferably of the same valence state, occupancy factors are obtained from the X-ray diffraction data refinement as follows: M(1), $0.84Mg+0.16Fe^{2+}$; M(2), $0.91Al+0.09Fe^{3+}$; M(3), $0.71Mg+0.29Fe^{2+}$; M(4), $0.98Na+0.02Ca$. These values lead to the chemical composition $(Na_{1.96}Ca_{0.04})(Mg_{2.39}Fe_{0.61}^{2+}Fe_{0.18}^{3+}Al_{1.82})Si_8O_{22}(OH)_2$.—*from* Author's abstract

00393 **Parham, Walter E.; Austin, George S.** Clay mineralogy, fabric, and industrial uses of the shale of the Decorah Formation, southeastern Minnesota: Minnesota Geol. Survey Rept. Inv. 10, 32 p., illus., 1969.

The Decorah shale varies both vertically and laterally in its clay mineral assemblages. Lateral variations are similar to those in the coextensive Glenwood Formation, suggesting that the source was the same, probably the Transcontinental Arch. The vertical variation from kaolinite and illite toward the base to only illite in the upper part reflects the transgressive nature of the Decorah sea. Engineering properties of the shale are related to orientation of clay minerals, especially permeability. Clay-mineral data suggest that the Decorah may be satisfactory for ceramic uses, and there are numerous areas along the outcrop belt satisfactory for open-pit mining.—*from* Authors' abstract

06620 **Parkash, Barham.** Beach sediments, Minas Basin, Bay of Fundy, Nova Scotia [abs.]: Maritime Sediments, v. 4, no. 2, p. 55, 1968.

06393 **Parker, D. C.** Remote sensing for engineering investigations of terrain—Infrared systems, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 701–709, illus., 1968.

Infrared imagery systems currently in use are described, together with desirable system improvements. Potential engineering applications to specific terrain localities include areas of geothermal activity, surface water, sparse vegetation, and soil moisture and ground water.—GWL

06444 **Parry, W. T.; Reeves, C. C., Jr.** Sepiolite from pluvial Mound Lake, Lynn and Terry Counties, Texas: Am. Mineralogist, v. 53, nos. 5–6, p. 984–993, illus., tables, 1968.

Long needles and fibrous bundles of authigenic sepiolite occur in lacustrine sediments of Mound Lake. The sepiolite is disseminated in illitic lacustrine clay immediately above a thin dolomite layer dated at 20,500 ± 650 yr B.P., disseminated in soft sediment dolomite some of which is apparently of Recent age, and disseminated throughout seven to eight feet of Recent playa fill. Sepiolite probably formed from montmorillonite in the lacustrine sediments when salinity of lake brines became extreme in response to an arid climatic cycle.—*from* Author's abstract

Patrick, D. J. *See* Thompson, R. N. 06709

00532 **Paul, R. W.** Petrographic and micropaleontologic studies of the Decaturville disturbance in Missouri—A progressive report [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 23, 1969.

Paulick, J. *See* Newesely, H. 06378

Paus, P. E. *See* Langmyhr, F. J. 06738

Paus, P. E. *See* Langmyhr, F. J. 06739

Pavlides, Louis. *See* Ayrton, William G. 00625

06621 **Pearson, Gene.** Mud deposition, gravel bar movement, and gravel transport in Parrsboro Harbour, Nova Scotia [abs.]: Maritime Sediments, v. 4, no. 2, p. 55, 1968.

00556 **Pease, Robert W.** Normal faulting and lateral shear in northeastern California: Geol. Soc. America Bull., v. 80, no. 4, p. 715–719, illus., 1969.

Extension of the Earth's crust is necessarily related to normal faulting. Causes of the necessary extension are obscure, however, and have been the subject of a variety of explanations. In northeastern California there is strong indication that the extension is the product of deep-seated right-lateral shear deformation related to the Walker Lane. Tectonic evidence, sharply etched in volcanic materials, suggests that (1) in a broad zone of lateral shear, normal faulting is due to the dynamic tension of the shear deformation and will differ in nature from that produced by compressive stress fields, and (2) an older set of Walker Lane lineaments exists which has been rotated away from present lateral stress and is now under constructional controls. Northeastern California provides evidence for the hypothesis suggested by Wise in 1963.—Author's abstract

06590 **Pelletier, B. R.** Current marine geology projects at the Atlantic Oceanographic Laboratory, Bedford Institute, Dartmouth, Nova Scotia: Maritime Sediments, v. 4, no. 2, p. 75–77, 1968.

Projects of this Laboratory were carried out over the Arctic and Atlantic continental shelves and slopes, the Arctic Archipelago, and major embayments of Canada as well as inshore and estuarine areas of Hudson Bay and the Atlantic Provinces. Parts of other areas in or adjacent to the North Atlantic Ocean were also studied, and special projects involved instrumental and equipment design. A resumé is given of the projects by authors and associates; highlights in discovery and progress are cited.—GDC

Pelletier, B. R. *See* Godden, C. A. 06608

06617 **Pelletier, B. R.** The submersible PISCES feasibility study in the Canadian Arctic: Maritime Sediments, v. 4, no. 2, p. 69–72, illus., 1968.

The 7-ton PISCES, for Arctic marine studies, is built to withstand hydrostatic stress of a 12,000-ft depth; it can be operated 8 hours at a maximum depth of 1,800 feet. An oil bladder and steel sphere reservoir control buoyancy and submergence; sonar and gyroscopic compass assist navigation. In dives in the far north, to test its use for geological exploration and mapping of the sea floor, a bathymetric chart was of considerable help, grounded icebergs were used as reference points for traverse, reflecting beacons served as sea-floor bench marks, and hull-mounted sounding and seismic equipment was connected inside by short cables. With hydraulic hammer, arm and claw retrieval, clam-shell grabber for large blocks, and a steel basket, over 20 sedimentary-rock samples were collected from sea floor and channel walls. Internal and external underwater photography supported observations.—GDC

06746 **Pendias, Henryk.** Główne i poboczne składniki chemiczne w amerykańskich, francuskich i niemieckich wzorcowych próbach skał [with English and Russian summ.]: Kwart. Geol., v. 12, no. 2, p. 221–233, illus., tables, 1968.

Nine standard rock patterns of international importance are presented: American granite G-1 and diabase W-1 macro- and micro-composition based on analyses from scores of laboratories; French granites GA and GH and basalt BR, main and secondary components determined in 15 centers, but with few trace-element analyses and considerable individual differences needing elaboration; German granite GM, basalt BM, shale TB, and limestone KH, based on analyses in laboratories of six eastern European countries, which carry on with a view to unequivocal determination of trace elements. For comparison of the nine standards, results of analyses and statistical data collected from sources materials were tabulated. Diagrams illustrate dependence of the value of relative derivation upon average content of a given component; the highest deviations are mainly concerned with small contents.—*from* Author's English summ.

06613 **Perkins, R. D.** Primary rhombic calcite in sedimentary carbonates: Jour. Sed. Petrology, v. 38, no. 4, p. 1371–1374, illus., 1968.

Primary rhombohedrons of calcite are more common in sedimentary carbonates than previously suspected. The reliability of identification of dolomite on the basis of

rhombic habit is therefore questioned, especially where rhombic crystals line voids.—Author's abstract

00446 **Perkins, Richard F.** Coal resources of Rocky Mountains and their future utilization [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 213-214, 1969.

Perry, Douglas. *See* Mitchum, Robert N. 00430

06537 **Perumalswami, P. R.** Interaction between dam and foundation during earthquakes [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2032B-2033B, 1968.

00499 **Pessagno, Emile A., Jr.; Brown, Walter R.** The microreticulation and sieve plates of *Racemiguembelina fructicosa* (Egger): Micropaleontology, v. 15, no. 1, p. 116-117, illus., 1969.

In the Upper Cretaceous foraminifer *Racemiguembelina fructicosa* (Egger), a microreticulation extending into the pores and continuous with sieve plates was discovered with the scanning electron microscope.—Authors' abstract

Peterson, Frank L. *See* Davis, Stanley N. 00491

06776 **Phillips, Evan R.; Ransom, D. M.** The proportionality of quartz in myrmekite: Am. Mineralogist, v. 53, nos. 7-8, p. 1411-1413, illus., 1968.

The authors suggest that the amount of quartz in myrmekite is proportional to the calcic content of associated plagioclase.—JSH

00392 **Phinney, W. C.** The Duluth Complex in the Gabbro Lake quadrangle, Minnesota—Text to accompany Minnesota Geol. Survey [Misc.] Map M2 [1966]: Minnesota Geol. Survey Rept. Inv. 9, 20 p., illus., tables, 1969.

Mapping of the lower Duluth Complex near Ely reveals a series of mafic intrusions against a basal contact of older Giants Range Granite. Oldest intrusive rock is gabbroic anorthosite consisting of several intrusions probably formed from a crystal mush. Intrusive into the anorthosite is the funnel-shaped Bald Eagle Intrusive with an outer zone of troctolite and an inner of gabbro; it is suggested that it formed by flowage while differentiation was taking place at depth. The South Kawishiwi Intrusion into the anorthosite is a troctolite mass, divided into a half-mile wide dike and a basin structure. The dike contains features indicating flow, and the basin contains shallow-dipping layers which indicate accumulation by settling. A number of dikes of varying composition also intrude the anorthosite. Economically significant deposits of copper and nickel are marked by gossans near the base of the troctolite basin and in the troctolite dike.—*from* Author's abstract

00454 **Picard, M. Dane; Aadland, Rolf; High, Lee R.** Correlation and stratigraphy of Triassic Red Peak and Thaynes Formations, western Wyoming and adjacent Idaho [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 216, 1969.

Pickett, E. E. *See* Reesman, A. L. 00470

06629 **Pilkey, Orrin H.** Sedimentation processes on the Atlantic southeastern United States continental shelf: Maritime Sediments, v. 4, no. 2, p. 49-51, 1968.

Sedimentological conclusions concerning the continental shelf of the southeastern United States are summarized, largely on the basis of recent term papers and thesis projects of geology students in the marine geology program at Duke University. The discussion is presented in the form of questions asked when studies began; it examines sources of sediment, fluvial and marine contributions, depositional regimes, age of particles, variation in rates of sedimentation, lateral transport, depositional environment of relict sediment, and preservation and redistribution.—GDC

00448 **Pillmore, Charles L.** Coal deposits of Raton coal field, New Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 214, 1969.

06478 **Plafker, George.** Source areas of the Shattered Peak and Pyramid Peak landslides at Sherman Glacier, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 374–382, illus., tables, 1968.

The 1964 earthquake triggered two major landslides that fell onto Sherman Glacier from Shattered Peak and Pyramid Peak, source volumes of which are 33.7 and 6.4 million yd^3, respectively; rock load added to the glacier is on the order of 83 million tons. Preexisting conditions were a combination of steep unstable slopes averaging more than 50° and local oversteepening at the foot of the slide blocks to angles of 70° or more, and the existence of potential surfaces of rupture in the form of pervasive bedrock fractures and steeply dipping bedding planes in a rhythmically bedded sequence of hard massive sandstone and some intercalated siltstone or argillite.—*from* Author's abstract

Plummer, Norman. *See* Huh, John M. 06372

06535 **Podio-Lucioni, Augusto.** Experimental determination of the dynamic elastic properties of anisotropic rocks, ultrasonic pulse method [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2016B, 1968.

06569 **Pollett, Frederick.** Peat resources of Newfoundland: Newfoundland and Labrador Dept. Mines, Agriculture and Resources Mineral Resources Rept. 2, 226 p., illus., tables, 1968.

The total area underlain by numerous and widespread peat deposits in the island of Newfoundland is approximately 7,800 sq mi; prevalent types are bog, fen, and marsh accumulations; most deposits are limited in size. Pleistocene glaciation played an important role by creating an environment favorable for bogland development. Fire has resulted in paludification which encouraged expansion of bogs over relatively dry ground and bedrock. Some 178 bogs were assessed in fair detail in this survey, and a number of others in a cursory manner; most have peat composed of raw to partly decomposed remains of sphagnum. Commercial grade peat moss was assessed as to thickness and volume; quality was determined by chemical analysis. Data indicated that commercial grade, quarriable material is present in deposits which individually contain as much as one million tons.—*from* Author's abstract

Poupon, A. *See* Gaymard, R. 06519

Prather, Bruce A. *See* Fergusson, William B. 06505

Prentice, F. J. *See* Burns, Roger G. 06581

00598 **Prest, V. K.; Steacy, H. R.; Bottrill, T. J.** Occurrences of uranium and vanadium in Prince Edward Island: Canada Geol. Survey Paper 68–74, 14 p., illus., tables, 1969.

Minor amounts of uranium associated with vanadium have been recognized in outcrop and at depth in the Permo–Carboniferous sediments of Prince Edward Island. Concentrations occur in greenish grey phases of the normally red sandstone, indicating a reducing environment. The uranium vanadates rauvite and francevillite, have been identified. Source of the uranium is believed to be older rocks to the west. Uranium is believed to have been precipitated under reducing conditions from percolating groundwaters.—Authors' abstract

Prewitt, C. T. *See* Shannon, R. D. 00616

06722 **Proctor, Richard J.** Geology of the Desert Hot Springs–upper Coachella Valley area, California, with a selected bibliography of the Coachella Valley, Salton Sea, and vicinity: California Div. Mines and Geology Spec. Rept. 94, 50 p., illus., tables, geol. map, 1968.

In Riverside County, where Transverse and Peninsular Ranges meet the Colorado Desert, Precambrian(?) gneisses with various Cretaceous(?) intrusions are termed the Chuckwalla complex; metamorphic spurs of the San Jacinto Mts. are probably late Paleozoic. Seven earlier named Cenozoic formations appear to be only four, with outcrop areas separated up to 10 miles by Recent sediments. Related to the fossiliferous marine Imperial formation, their equivalent conglomeratic and sandy facies are: Coachella–Split Mountain; Painted Hill–Canebrake and interfingering Palm Spring; and Cabezon–Ocotillo formations. Mission Creek fault, in the San Andreas system, shows Recent displacement of 1,100 feet vertically and 800 laterally; local intrusions suggest pre-Quaternary movements. Subparallel in a small Indio Hills area are 12 mappable folds.—GDC

00474 **Pytkowicz, R. M.; Kester, D. R.** Harned's rule behavior of $NaCl$–Na_2SO_4 solutions explained by an ion association model: Am. Jour. Sci., v. 267, no. 2, p. 217–229, illus., tables, 1969.

Short range interactions between sodium and sulfate ions, in aqueous solutions of ionic strengths between 0.3 and 1.0 at 25°C, were studied potentiometrically with sodium sensitive glass electrodes. The ion association model in terms of ion pair formations permitted a reduction of data. A modified expression of Harned's rule, derived from the model, provided a better description of the behavior of the sodium chloride activity coefficient in $NaCl$–Na_2SO_4 solutions than that provided by the usual form of Harned's rule. Values of the constant as a function of the ionic strength, I, followed the relation $K = 2.73 - 2.58I^2 + 2.28I$. The value of the constant is 2.02 ± 0.03 for the range of salinities normally encountered in the oceans.—*from* Authors' abstract

Quaide, W. L. *See* Oberbeck, V. R. 00544

Quigley, Galen. *See* Corpus Christi Geological Society. 06758

00533 **Quinn, James H.** Extinct vertebrates of Recent age, Newton County, Arkansas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 23, 1969.

06687 **Rad, Ulrich von.** Comparison of sedimentation in the Bavarian flysch (Cretaceous) and Recent San Diego trough (California): Jour. Sed. Petrology, v. 38, no. 4, p. 1120–1154, illus., tables, 1968.

The study of 95 undisturbed box cores from La Jolla submarine fan and central San Diego trough shows that most sand layers which have well-preserved flysch-type sedimentary structures are discontinuous, elongate lens-shaped bodies. Parallel and current-ripple cross-laminated beds are more abundant than complete graded cycles. The sand transport was down valley and transverse to the trough axis along the fan valley, and longitudinal along the axis of the trough. Bottom-currents with tide-related flow are known and are the cause of most of the transport or reworking of recent sediments, rather than the spasmodic, high-velocity turbidity currents. The lithofacies of the San Diego trough "flysch" and Bavarian flysch is roughly similar whereas the extent and continuity of the sand layers appear to be strikingly different.—*from* Author's abstract

00605 **Radtke, Arthur S.; Taylor, Charles M.; Morris, Hal T.** Micromineralogy of galena ores, Burgin mine, East Tintic district, Utah: U.S. Geol. Survey Prof. Paper 614-A, p. A1–A17, illus., table, 1969.

Analyses of argentiferous galena ores from the Burgin mine, Utah, by electron microprobe, emission spectograph, and wet chemical method indicate distinctly different amounts of silver in two general types of galena. Massive coarse-grained galena contains an average 0.22 percent silver by weight (approximately 64 ounces per ton), whereas fine-grained galena has less than 0.04 weight-percent silver (approximately 12 ounces per ton). The primary silver minerals dispersed in the galenas include polybasite, tetrahedrite, and jalpaite. Secondary silver sulfides, including argentite (or acanthite) and jalpaite, are concentrated in cerussite along fractures.—Authors' abstract

Ragle, Richard H. *See* Johnson, Noye M. 06477

Rama Rao, B. *See* Baur, W. H. 06447

00515 **Ramanujam, C. G. K.; Stewart, Wilson N.** Taxodiaceous bark from the Upper Cretaceous of Alberta: Am. Jour. Botany, v. 56, no. 1, p. 101–107, illus., 1969.

The structure of a piece of silicified bark of *Taxodioxylon gypsaceum* from near Medicine Hat in southern Alberta is described. The fossil specimen probably came from Upper Cretaceous beds. The fossil shows affinities with the bark of modern *Sequoia*. *Vectia luccombensis* Stopes (1915) from the lower Greensand (Aptian) of England probably constitutes an isolated piece of taxodiaceous bark, similar to the inner bark of the Alberta specimen.—Authors' abstract

Ransom, D. M. *See* Phillips, Evan R. 06776

00584 **Rashid, M. A.; King, L. H.** Molecular weight distribution measurements on humic and fulvic acid fractions from marine clays on the Scotian Shelf: Geochim. et Cosmochim. Acta, v. 33, no. 1, p. 147–151, illus., tables, 1969.

The molecular weight distribution of humic and fulvic acids extracted from marine clays was determined on Sephadex gels using the column chromatographic technique. The results show a wide spread in molecular weight ranging from less than 700 to over 2,000,000.—Authors' abstract

06787 **Raup, Omer B.; Gude, Arthur J., 3d; Dwornik, E. J.; Cuttitta, Frank; Rose, Harry J., Jr.** Braitschite, a new hydrous calcium rare-earth borate mineral from the Paradox Basin, Grand County, Utah: Am. Mineralogist, v. 53, nos. 7–8, p. 1081–1095, illus., tables, 1968.

Braitschite occurs in white to reddish-pink nodules which constitute a zone in anhydrite rock immediately overlying a potash bed. Crystals of braitschite are colorless to white, very small hexagonal plates with only pinacoid and prism forms. Specific gravity is 2.903 ± 0.002 (meas.), 2.837 (calc.). Optically, uniaxial positive, $\epsilon = 1.647$, $\omega = 1.646$. The unit cell is hexagonal, $a = 12.156 \pm 0.001$ A, $c = 7.377 \pm 0.005$ A, $Z = 1$. Strongest lines of the X-ray diffraction pattern (in A) are: 10.52 (54) (100); 4.283 (100)(102); 3.168 (45)(301); 3.155 (38)(112); 3.021 (92)(202).—*from* Authors' abstract

Ray, L. L. *See* Schultz, C. Bertrand. 00535

00470 **Reesman, A. L.; Pickett, E. E.; Keller, W. D.** Aluminum ions in aqueous solutions: Am. Jour. Sci., v. 267, no. 1, p. 99–113, illus., tables, 1969.

The free energy of formation ($\Delta G°_f$) of $Al(OH)_4^-$ and $Al(OH)_2^+$ were estimated as -311.3 and -216.1 kcal/mole, respectively, from aqueous solubility data of high alumina and aluminum silicate clay minerals. The p^*Ks_4 and pKs_2 for boehmite are 14.4 and 15.0 respectively, yielding an isoelectric point at pH of 6.70. Electrophoretic migration of aluminum ions at various phases of pH indicate that the relative effective charge on the anionic forms of aluminum ions between pH 10.0 and 12.5 are approximately equal and opposite to the cationic forms between pH 4.07 and 2.85. A marked three-fold increase in distance of migration occurred between pH 2.85 and 1.0, indicating a probable three-fold increase in effective charge, $Al(OH)_2^+$ to Al^{3+}, had occurred within this range in pH.—Authors' abstract

06583 **Reesman, A. L.; Keller, W. D.** Aqueous solubility studies of high-alumina and clay minerals: Am. Mineralogist, v. 53, nos. 5–6, p. 929–942, tables, 1968.

Solubility constants and standard free energies of formation for the following minerals were calculated from data on concentrations of ions dissolved in aqueous solutions of these minerals: dickite, kaolinite (in ball clay), "fire clay mineral", halloysite, endellite, montmorillonite (Cheto), montmorillonite (Clay Spur), gibbsite, boehmite, diaspore, pyrophyllite, and muscovite.—*from* Authors' abstract

Reeves, C. C., Jr. *See* Parry, W. T. 06444

00437 **Reeves, Corwin C., Jr.** Texas lineament—Pleistocene–Holocene movement? [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 209, 1969.

Reiners, W. A. *See* Buell, Murray F. 06705

00600 **Repenning, C. A.; Jones, D. L.; Addicott, W. O.** Geology of the Great Valley: California Div. Mines and Geology Mineral Inf. Service, v. 22, no. 1, p. 3–6, illus., reprinted 1969; originally published 1966.

This paper was originally published in *Mineral resources of California*: U.S. Cong., 89th, 2d sess., Comm. Interior and Insular Affairs, Comm. Print (California Div. Mines and Geology Bull. 191), p. 48–54, illus., 1966. Photographic illustrations have been added to the 1969 paper.—ESL

Rexroad, Carl B. *See* Nicoll, Robert S. 06701

06484 **Reynolds, Mitchell W.** Geologic map of the Muddy Gap quadrangle, Carbon County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ–771, scale 1:24,000, sections, 1968.

06485 **Reynolds, Mitchell W.** Geologic map of the Whiskey Peak quadrangle, Carbon, Fremont, and Sweetwater Counties, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ–772, scale 1:24,000, sections, 1968.

06357 **Rib, Harold T.** Remote sensing applications to highway engineering, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 725–736, illus., table, 1968.

The availability of new remote sensors (e.g., radar, infrared, multichannel) to highway engineers in recent years has initiated a new era in the application of interpretation techniques to highway engineering. The data provided by the various sensors furnish information previously unobtainable, or available only at great expense. In this paper the areas of possible application of remote sensors in the highway field are discussed. Several examples are included to demonstrate the value of remote sensors in various aspects of highway engineering. Also included is a discussion of the Bureau of Public Road's research program in remote sensing.—Author's abstract

Ribbe, P. H. *See* VanSchmus, W. R. 06684

00480 **Rich, Mark.** Petrographic analysis of Atokan carbonate rocks in central and southern Great Basin: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 340–366, illus., tables, 1969.

The Atokan Series in east-central and southern Nevada and western Utah is a repetitive sequence of carbonate rocks belonging to the Ely Group. Nine limestone types indicative of environmental energy, relative depth, and biologic distribution are recognized by petrographic analysis: type 1, spiculiferous fine-grained limestone (deep water deposition); type 2, fine-grained limestone and skeletal calcarenitic limestone (deep water deposition); type 3, mud-supported calcarenitic limestone with pelletoid grains absent or not abundant; type 4, grain-supported calcarenitic limestone with pelletoid grains absent or subordinate; type 5, fine-grained and medium-grained calcarenite; type 6, coarse calcarenite and calcirudite (high energy deposition); type 7, mud-supported and grain-supported pelletoid calcarenite limestone; type 8, *Komia* limestone; type 9, *Donezella* limestone (deep water deposition).—*from* Author's abstract

Richardson, K. A. *See* King, E. A., Jr. 00552

06730 **Richardson, Peter D.** The generation of scour marks near obstacles: Jour. Sed. Petrology, v. 38, no. 4, p. 965–970, illus., 1968.

Current crescent scour marks can be explained as effects of the stretching and accumulation of the vorticity in flow approaching an obstacle, the fluid-mechanical aspects of vorticity transport being described in some detail. The observed differences between the scour-remnant ridges and scour-deposited ridges may be explained in terms of differences in flow configuration geometry. Sediment transport depends not only on the range of values of fluid vorticity but also upon the sequence in which the values in the range are obtained. This aspect of transport phenomena is emphasized and it is suggested that experiments should be performed to determine the sensitivity of the functionals to the flow functions.—*from* Author's abstract

06384 **Risley, Edward.** Remote sensing activities of committees of the National Research Council, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 941-944, 1968.

A brief review of the remote sensing activities of committees and panels of the National Research Council is presented.—GWL

06363 **Ritchot, Gilles.** Aperçus géomorphologiques de l'Estrie [with English and German abs.]: Rev. Géographie Montreal, v. 22, no. 2, p. 109-132, illus., 1968.

The Appalachian Highlands of the Eastern Townships near Montreal are characterized by a system of wide smooth valleys with slopes interrupted by rocky ledges not explainable by any morpho-climatic erosional system. The statistical relations between the slope steepness, valley depth, ledge frequency, and the like indicate that the valley forms can be explained by general erosion laws only; the valleys are by cyclic erosion, and the ledges are planation surfaces. The end-glacial outwash plains and terraces have been influenced by the pre-existing topography of the rock floor and, thus, a geographic classification of the Quaternary landforms, based on their relations with the rocky landforms, has been drawn up and may be applied to the geomorphologic study of the central Eastern Townships.—*from* Author's English abstract

00458 **Ritzma, Howard R.** Petroleum potential of Utah [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 217-218, 1969.

06683 **Roberson, C. E.; Hem, J. D.** Activity product constant of cryolite at 25°C and one atmosphere using selective-ion electrodes to estimate sodium and fluoride activities: Geochim. et Cosmochim. Acta, v. 32, no. 12, p. 1343-1351, tables, 1968.

The activity product constant of cryolite at 25°C and 1 atm total pressure was calculated from data for solutions from which synthetic cryolite or mixtures of cryolite and a solid apparently related to ralstonite had precipitated. The activities of fluoride and sodium were estimated using specific ion electrodes. The activity product constant is calculated to be $10^{-33.84}$, and the standard free energy of formation at 25°C is -745.4 ± 1.0 kcal per mol. The relative scarcity of cryolite in nature suggests that perhaps solutes other than those occurring in the structure may inhibit or prevent the formation of cryolite.—*from* Authors' abstract

06358 **Robinove, Charles J.** The status of remote sensing in hydrology, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 827-831, 1968.

Remote-sensing research in hydrology has not kept up with research in other fields. Areas of major importance are ground-water exploration, snow and ice mapping, physical and chemical parameters of water bodies, measurement of evaporation and transpiration, and erosion and sedimentation studies. Aerial photographic techniques will continue to be the most used. Rigorous physical and chemical research provides the best chance for successful evaluation and development of remote sensing techniques in hydrology.—GWL

06502 **Robinson, G. D.; Klepper, M. R.; Obradovich, J. D.** Overlapping plutonism, volcanism, and tectonism in the Boulder batholith region, western Montana, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 557-576, illus., table, 1968.

Recent stratigraphic, structural, paleontologic, and radiometric evidence makes it possible to date dynamic events in the Boulder batholith region closely. Time relations form an intertwined complex of volcanism–folding–thrusting–batholith emplacement. These events began and ended within a few million years of each other, during the last 20 m.y. of the Cretaceous. Major folding, thrusting, and volcanism started about the same time and a little earlier than plutonism. In any given locality, volcanism ended before major folding; the climax of plutonism followed that of volcanism; thrusting preceded and accompanied plutonism near the batholith, but followed plutonism farther away; thrusting ended a little later than folding. Gilluly's conclusion that orogeny producing Cretaceous thrusts of Montana was 'essentially without plutonic associations' is not tenable.—*from* Authors' abstract

06578 **Robinson, Paul T.; McKee, Edwin H.; Moiola, Richard J.** Cenozoic volcanism and sedimentation, Silver Peak region, western Nevada and adjacent California, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 577–611, illus., table, geol. map, 1968.

Cenozoic deposits of the Silver Peak region, western Nevada, and adjacent California, consist of continental sedimentary and pyroclastic rocks of the Esmeralda Formation and lavas and tuffs of the Silver Peak volcanic center. Sedimentary rocks, comprising thick sequences of tuffaceous volcanic sandstone and siltstone and interbedded air-fall tuff, were deposited in basins coinciding with present valleys; conglomerate and sandstone occur along basin margins. Sediments range in age from late Miocene to late Pliocene; oldest reliably dated rocks in the Esmeralda Formation are 13.1 m.y.; all are younger than an ash-flow sheet dated at 21.5 m.y. An air-fall tuff in the upper part is 4.3 m.y. old. Rhyolite and trachyandesite tuffs and flows of the Silver Peak volcanic center, 4.8 to 6.1 m.y., crop out in the central part of Silver Peak Range.—*from* Authors' abstract

Rogers, J. *See* Landis, C. A. 06450

06771 **Roland, George W.** Synthetic trechmannite: Am. Mineralogist, v. 53, nos. 7–8, p. 1208–1214, illus., table, 1968.

A phase of $AgAsS_2$ composition prepared by crystallizing $AgAsS_2$ glass at 290°C for 315 hours is identical to the rare sulfosalt mineral trechmannite. The synthetic material is hexagonal (rhombohedral) and least-squares refinement of X-ray powder-diffraction data yields a(hex) = 13.967 angstroms, c(hex) = 9.135 angstroms, and c(hex)/a(hex) = 0.6540 in agreement with values reported for natural trechmannite. X-ray powder-diffraction data for synthetic trechmannite and optical properties for both synthetic smithite and trechmannite in polished section are reported.—*from* Author's abstract

06633 **Romig, Phillip R.; Major, Maurice W.** Secular strains in NE Denver [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 14–15, 1968.

06744 **Root, Samuel I.** Geology and mineral resources of southeastern Franklin County, Pennsylvania: Pennsylvania Geol. Survey, 4th Ser., Atlas 119cd, 118 p., illus., tables, geol. map, 1968.

Easternmost South Mountain has Precambrian Catoctin greenstones under 4,000 feet of Lower Cambrian quartzites and Antietam Formation; but this area is mostly lowlands of the Great Valley where Cambrian to Middle Ordovician units aggregate 14,000 feet of marine carbonates. Their parallel folds and faults reflect flow cleavage and geometry of the anticlinorium; many asymmetric to overturned folds can be traced 30 miles to the Potomac River. The overlying younger Martinsburg Formation is a structurally complex flysch sequence of the Massanutten synclinorium. Homoaxial stages in deformation include folding, later faulting, and block translation. Limestones may be exploited locally for chemical, metallurgical, and aggregate uses, and Martinsburg shale for aggregate and brick. Ground-water possibilities are summarized briefly.—GDC

Rose, Harry J., Jr. *See* Raup, Omer B. 06787

06646 **Rose, J. N.** The eyes of *Isotelus* and *Nileus*: Iowa Acad. Sci. Proc. 1967, v. 74, p. 178–185, illus., table, 1968.

Facet counts and measurements indicate that growth in the holochroal eyes of [the asaphid trilobites] *Isotelus iowensis* and *Nileus vigilans* is accomplished by addition of new facets at the base, probably during molting, and by increase in the size of the largest facets; the former is the dominant process. The rate of addition of facets appears to be nonuniform in many individuals. [Specimens for this study were collected from the Elgin Member of the Upper Ordovician Maquoketa Formation, near Clermont, Fayette County, Iowa.]—Author's abstract

06582 **Rosenberg, P. E.** Subsolidus relations on the dolomite join, $CaMg(CO_3)_2$–$CaFe(CO_3)_2$–$CaMn(CO_3)_2$: Am. Mineralogist, v. 53, nos. 5–6, p. 880–889, illus., 1968.

Subsolidus relations were determined largely at 450°C and 2–3 kbars pressure. One, two, and three phase regions are present. Some solid solutions are ordered whereas others are disordered. The addition of manganese carbonate appreciably changes the position of the phase boundaries of the Ca–Fe–Mg carbonate system. The manganese content of dolomite must be considered if the iron content of dolomite is to be used as a geothermometer.—JSH

06597 **Ross, Clarence S.; Bergquist, Harlan R.; Monroe, Watson H.; Fahey, Joseph H.; Ross, Malcolm.** Natroalunite in Upper Cretaceous sedimentary rocks, north-central Texas: Jour. Sed. Petrology, v. 38, no. 4, p. 1155–1165, illus., tables, 1968.

Natroalunite occurs typically here as thin lenses of nodules in friable sandstone at or near the Eagle Ford–Woodbine disconformity of the Upper Cretaceous. Typical natroalunite has only traces of impurities; it is exceedingly fine-grained but retains a replica of radial plumose structure which is reflected by the cauliflower-like outer form. Thus, the nodules were derived by transformation from material with spherulitic structures. Minor K_2O is present, and essential Ca, Sr, Ba, Mg, and rare earths. A deficiency of bases is believed to be compensated for by oxonium H_3O^+ ions. The natroalunite is believed to have developed under oxidizing conditions, with pyrite as the source of the SO_4. Experiments suggest its derivation to be from aluminite.—*from* Authors' abstract

00603 **Ross, Donald C.** Descriptive petrography of three large granitic bodies in the Inyo Mountains, California: U.S. Geol. Survey Prof. Paper 601, 47 p., illus., tables, 1969.

Petrographic and chemical data and regional relations are discussed for the three granitic plutons of the northern Inyo Mountains. These plutons are the Pat Keyes, part of the Hunter Mountain Quartz Monzonite and unlike other plutons varying in composition; the Paiute Monument Quartz Monzonite; and the Santa Rita Flat pluton, part of the Tinemaha Granodiorite. Data support the thesis that these rocks are of intrusive rather than replacement origin. Potassium–argon age determinations indicate an Early Jurassic age for the Santa Rita Flat and Pat Keyes plutons and a Middle Jurassic age for the Paiute Monument Quartz Monzonite which intrudes the Pat Keyes pluton.—VSN

06568 **Ross, Malcolm; Smith, William L.; Ashton, William H.** Triclinic talc and associated amphiboles from Gouverneur mining district, New York: Am. Mineralogist, v. 53, nos. 5–6, p. 751–769, illus., tables, 1968.

Chemical, optical, and X-ray data are given for talc, tremolite, and tirodite from the Gouverneur mining district, N.Y. All talc is triclinic, $a = 5.25_5$, $b = 9.13_7$, $c = 9.44_8$ A, $\alpha = 90°46'$, $\beta = 98°55'$, $\gamma = 90°0'$, space group C1 or Cl, structure type 1-layer triclinic (1Tc), and composition is $Mg_{3.04}Si_{3.96}O_{10}F_{0.10}(OH)_{1.90}$. Two of the tremolite specimens have prominent lamellae, oriented parallel to (101), of a second amphibole having the unit-cell parameters: monoclinic, $a = 9.50$, $b = 18.04$, $c = 5.28$ A, $\beta = 102°25'$, space group $P2_1$ or $P2_1/m$. This amphibole is tirodite; approximate composition is given. It probably exsolved from the host tremolite at temperatures below 500°C.—*from* Authors' abstract

Ross, Malcolm. *See* Ross, Clarence S. 06597

Ross, Reuben J., Jr. *See* McKee, Edwin H. 00483

06530 **Roth, James Richard.** The equilibrium between labile and crystalline phosphates in soils [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 1902B, 1968.

06676 **Rowe, M. W.** On the origin of excess heavy xenon in primitive chondrites: Geochim. et Cosmochim. Acta, v. 32, no. 12, p. 1317–1326, illus., tables, 1968.

In heating experiments, xenon was studied in separated matrix and chondrule samples of the Mokoia carbonaceous chondrite and the Chainpur unequilibrated ordinary chondrite. Larger isotopic anomalies in the heavy xenon were found than have previously been seen in carbonaceous chondrites. Pu–244 spontaneous fission decay in place is an unlikely source for the excess heavy xenon. A "carrier" hypothesis is suggested as an alternative source.—Author's abstract

00534 **Rowell, A. J.** Relative entropy and faunal distribution maps [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 24, 1969.

Rowett, Charles L. *See* Minato, Masao. 06660

06557 **Rowley, Peter DeWitt.** Geology of the southern Sevier Plateau, Utah [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2091B, 1968.

06596 **Royse, Chester F., Jr.** Recognition of fluvial environments by particle-size characteristics: Jour. Sed. Petrology, v. 38, no. 4, p. 1171–1178, illus., table, 1968.

Traction and graded-suspension loads are confined to stream channels, whereas uniformly suspended material in the upper part of the water column escapes the channel during overbank flow; the effects of these relationships are evident on CM diagrams. As a first approximation, graded, uniform, and "pelagic" CM patterns can be interpreted as representative of channel-proximal, flood plain, and flood basin environments. Ternary plots of sand, silt, and clay contents of fluvial sediments also produce characteristic patterns, but are less useful than CM diagrams for environmental interpretation. Recognition of the presence and relative abundance of different fluvial facies should be valuable in general considerations of paleoflow regime, paleoslope stability, and factors relating to local and regional events.—*from* Author's abstract

Rupert, J. Paul. *See* Wright, Alan C. 06785

Rust, B. R. *See* Coakley, J. P. 06602

06558 **Rust, Claude Charles.** Conodonts of the Martinsburg Formation (Ordovician) of southwestern Virginia [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2091B, 1968.

00609 **Rutten, M. G.** The *ganggefolgschaft*, a diagnostic feature to distinguish between plutons and rheo-ignimbritic pseudo-plutons: Geol. Soc. America Bull., v. 80, no. 3, p. 545–548, 1969.

Pseudo-plutons commonly occur in areas of ignimbrites and consist of rocks, commonly felsic, derived from magma left in crater vents at the close of ignimbritic eruptions. Secondary melting resulting from residual heat has caused formation of rheo-ignimbrite. Larger bodies of similar rock are believed to represent solidified fillings of chambers that were sources of ignimbritic magma. Distinct thin encasing selvages, and associated *ganggefolgschaft* (dike clusters), which characterize more common migmatitic plutons, are not associated with pseudo-plutons. Evidence of high fluidity, which would be lost during explosive eruptions, and lack of air sorting indicate that ignimbrites are erupted quietly.—WHN

00622 **Sabins, Floyd F., Jr.** Thermal infrared imagery and its application to structural mapping in southern California: Geol. Soc. America Bull., v. 80, no. 3, p. 397–404, illus., 1969.

Thermal infrared imagery is obtained by airborne scanning devices that detect thermal radiation from the Earth's surface and record it as an image in which bright tones represent relatively warm temperatures. Scanners sensitive to wavelengths between 8 and 14 microns span the radiant power peak of the Earth at 9.7 microns and coincide with an atmospheric 'window'. An example of 8 to 14 micron nighttime infrared imagery from the Imperial Valley is interpreted and compared with aerial photographs. In this monotonous-appearing desert terrain, the imagery exhibits greater contrast and geologic detail than the photography. On the imagery, deformed Tertiary sedimentary bedrock (relatively cool) is distinguished from Holocene windblown sand cover (relatively warm). A faulted plunging anticline, obscure both on aerial photographs and to a ground observer, is clearly shown in the nighttime infrared imagery.—*from* Author's abstract

00541 **Sanders, J. E.; Emery, K. O.; Uchupi, Elazar.** Microtopography of five small areas of the continental shelf by side-scanning sonar: Geol. Soc. America Bull., v. 80, no. 4, p. 561–571, illus., 1969.

The microtopography of the continental shelf in five areas betwen Nova Scotia and New York was investigated with side-scanning sonar. The results were checked against those previously obtained by conventional methods in all areas and against later visual observations of the bottom from a research submersible vessel in two areas. Side-scanning sonar proved to be an ideal device for learning the distribution and relationships of rock, boulder, and sand bottoms and for measuring the patterns and trends of several sizes of sand waves and of large ripple marks.—Authors' abstract

06391 **Sanders, John E.; Clay, C. S.** Investigating the ocean bottom with side-scanning sonar, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 529–547, illus., 1968.

Side-looking sonar equipment is well suited for use from surface ships in studying and mapping continental shelves. The equipment and the nature of the graphic records generated are described. Side-scanning sonar records are discussed for Buzzards Bay, Mass., and Cashes Ledge in the Gulf of Maine. Features as small as sand ripples 10 cm high, changes in particle size of bottom sediments, shapes and trends of sand waves, and locations of rock outcrops and of manmade objects have been mapped. Problems of side-looking sonar are: 1. the sound energy beamed into the water may come back as multiple returns from features on the bottom as well as from irregularities on the surface and within the water; 2. the absence of returning sound energy is not subject to unique interpretation; 3. the lateral range is only 0.75 km; and 4. the transducer must be towed within 50 m of the bottom.—GWL

Sanders, John E. *See* Friedman, Gerald M. 06599

06609 **Sanders, John E.** Diver-operated simple hand tools for coring nearshore sands: Jour. Sed. Petrology, v. 38, no. 4, p. 1381–1386, illus., 1968.

Equipment for use by SCUBA divers to collect cores of firmly packed nearshore sands up to six feet long is described. The tools consist of plastic sampling tubes, steel hammering cap and hammering sleeve, aluminum extracting handle, and metal and rubber sealing plug. These tools are simple, rugged, inexpensive to build, and can be operated entirely by touch in waters of zero visibility. They were used in August 1962 off the Virginia coast, and in August 1967, off Long Island to collect cores of nearshore quartzose sands of varying grain size, and in March 1965, off the north coast of Jamaica, to collect cores of carbonate sands and muds.—Author's abstract

06622 **Sandusky, C. L.** Sand distribution from a point source [abs.]: Maritime Sediments, v. 4, no. 2, p. 55, 1968.

06752 **Sanero, E.; Gottardi, G.** Nomenclature and crystal-chemistry of axinites: Am. Mineralogist, v. 53, nos. 7–8, p. 1407–1411, illus., 1968.

A suggested nomenclature of axinites, based on a triangular diagram of pure Ca-, Mn-, (Fe,Mg)- molecules, has been approved by the New Minerals and Mineral Names Commission of the IMA. It proposes that (1) the name "axinite" be used as a groip name; (2) "ferroaxinite" be used for the end-member $HCa_2FeAl_2BSi_4O_{16}$ and for those axinites in which Ca>1.5 and Fe>Mn; (3) "manganaxinite" be used for the end-member $HCa_2MnAl_2BSi_4O_{16}$ and for those axinites with Ca>1.5 and Mn>Fe; (4) the name "tinzenite" be used for those axinites with Ca< 1.5 and Mn>Fe.—MEM

06507 **Sarich, Vincent M.** The origin of the hominids—An immunological approach, [Chap.] 6 *in* Perspectives on human evolution, V. 1 (S. L. Washburn and Phyllis C. Jay, editors): New York, Holt, Rinehart and Winston, p. 94–121, illus., tables, 1968.

Estimate of time of origin of the hominid line cannot be based accurately on the scanty fossil record alone. Rate of evolution of the serum albumin macromolecule has been shown, by quantitative immunological study using the micro-complement fixation technique, to be constant for species of hominoids and lower primates, and is interpreted as having been relatively constant throughout the Tertiary. Tracing the lineages backward in time, aided by the available fossil record, it is shown that lines leading to man, gorilla, and chimpanzee diverged at the same time, about 3.5 m.y. ago (late Pliocene), the gibbon having diverged about 7 m.y.; hominoids diverged from cercopithecoids about 22 m.y. (early Miocene); platyrrhines from catarrhines about 36 m.y.; anthropoids from prosimians about 60 m.y.—VMJ

Sato, Y. *See* Landisman, M. 06651

Sattinger, Irvin J. *See* Muir, Allan H. 06383

06717 **Saunders, John M.; Havey, Robert W.** Development of a narrow-beam, bathymetric programmer, *in* Marine sciences instrumentation, V. 4—Instrument Soc. America Symposium, 4th Natl., Cocoa Beach, Fla., 1968, Proc.: New York, Plenum Press, p. 70–77, illus., tables, 1968.

The Narrow Beam Bathymetric Programmer is an automatic time coding device designed to eliminate problems caused by the scattering layer and interference between the transmitted pulse and the echo pulse. This technique attains a high data rate without the constant operator attention and reprogramming that are required in other bathymetric systems.—Authors' abstract

06653 **Savage, J. C.; White, W. R. H.** A map of Rayleigh wave dispersion in the Pacific [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 11, 1968.

00478 **Saxena, S. K.; Hollander, N. B.** Distribution of iron and magnesium in coexisting biotite, garnet, and cordierite: Am. Jour. Sci., v. 267, no. 2, p. 210–216, illus., table, 1969.

The distribution of iron and magnesium among coexisting cordierite, biotite, and garnet indicates that the cordierite is close to an ideal solid solution (Fe-Mg) in P-T conditions of epidote-amphibolite facies, but it may be nonideal (or in disequilibrium) in P-T conditions of high amphibolite or granulite facies.—Authors' abstract

06445 **Saxena, S. K.** Distribution of elements between coexisting minerals and the nature of solid solution in garnet: Am. Mineralogist, v. 53, nos. 5–6, p. 994–1014, illus., tables, 1968.

Distribution of iron and magnesium between garnet and coexisting orthopyroxene, hornblende or biotite is orderly. In garnets of high grade rocks of the granulite facies, Fe^{2+}, Mg and Mn form a nearly ideal mixture and the role of Ca is mainly that of dilution. In garnets of low grade rocks of the epidote-amphibolite facies Fe^{2+}, Mn, and Ca tend to mix ideally but the role of Mg in such garnets could

not be ascertained. The composition of garnets alone does not indicate unambiguously the metamorphic grade of the host rocks of variable composition; but in an isochemical rock series, the ratio Mg/Fe^{2+}, along with the concentration of Ca in garnets containing little Mn, may roughly indicate the metamorphic grade.—*from* Author's abstract

06589 **Schafer, Charles T.; Sen Gupta, Barun K.** Benthonic foraminiferal ecology in Port Castries Bay, St. Lucia—A preliminary report: Maritime Sediments, v. 4, no. 2, p. 57–63, illus., tables, 1968.

St. Lucia Island, half-way between Martinique and St. Vincent in the West Indies, is separated from them by deep channels. Port Castries Bay, on the leeward side, averages 11 m in depth; bottom water temperatures are 26–28°C in late winter and salinities between 34 and 36 per mille; the pH of bottom water is usually higher than that of bottom sediment; its central parts have higher concentrations of phosphates, nitrates and nitrites. Size distribution of sediments is controlled by water depth and proximity to shore, mouth of bay, and mouth of Castries River. Abundance of living Foraminifera is considerably less than in more northerly waters; in the total benthonic assemblage of 112 species, 46 are recorded as living. A maximum living total ratio of 31 percent off the river mouth indicates relatively rapid sedimentation. The very low planktonic/benthonic ratio is typical of shallow, nearshore conditions.—GDC

06531 **Schafer, John William, Jr.** Nitrogen carrier induced changes in chemical, mineralogical and microbial properties of a sandy loam soil [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 1902B–1903B, 1968.

06713 **Schlaepfer, Carmen J.** Carta geológica de México—Hoja México 14Q-h(5): México, D.F., Univ. Nac. Autónoma México, Inst. Geología, scale 1:100,000, sections, text, 1968.

The map area includes Mexico City and the surrounding regions of the States of México and Morelos. The Tertiary System and the general geology of this section of la Cuenca de Mexico are outlined in detail.—MCM

06751 **Schmidt, E. D. D.; Kirk, J. L.; Vedam, K.** Variation of the refractive index of diamond with hydrostatic pressure to 7 kilobars: Am. Mineralogist, v. 53, nos. 7–8, p. 1404–1406, illus., 1968.

The variation of the refractive index of diamond with pressure for a wavelength of 5893 angstroms was observed to be -0.85×10^{-4}/kbar. These results are discussed with consideration of previous observations.—JLH

06659 **Schnable, Jon E.; Goodell, H. Grant.** Pleistocene-Recent stratigraphy, evolution, and development of the Apalachicola coast, Florida: Geol. Soc. America Spec. Paper 112, 72 p., illus., tables, 1968.

Pleistocene sediments, which thicken to the southwest, have been deposited on an uneven Miocene surface of variable age. The thickest section consists of two superimposed sequences of clastic sediments grading upward from coarse to fine and representing two major late Pleistocene sea-level fluctuations. Radiocarbon dates and stratigraphy indicate that the upper probably represents a mid-Wisconsin, and the lower a Sangamon transgression of the sea. Thickest Recent sediments occupy the old Apalachicola River valley, cut during the last lowering of sea level, filled with sediments, and inundated by the Recent rise in sea level. A high stand near present sea level, between 24,000 and 40,000 yr B.P., probably corresponds to Silver Bluff shoreline of Florida and Georgia. Sea level was 10 to 15 feet below present between 4,000 and 4,500 years ago.—*from* Authors' abstract

00553 **Schoen, Robert.** Rate of sulfuric acid formation in Yellowstone National Park: Geol. Soc. America Bull., v. 80, no. 4, p. 643–649, illus., tables, 1969.

Sulfuric acid forms near sulfurous hot springs as the result of oxidation of hydrogen sulfide exhalations by atmospheric oxygen. Four tracts of acid-altered ground were studied in order to determine the rate at which sulfuric acid is forming. Although

the size of the hot-springs areas varied by as much as a factor of 19, acid production was nearly uniform at about 10 grams per sq m of area per day. The near constancy of acid production per unit area implies that the area of land surface is a major control of the oxidation reaction of sulfide to sulfate. This is consistent with a biological origin for the acid by aerobic sulfur-oxidizing bacteria living close to the land surface.—*from* Author's abstract

Schonfeld, E. *See* King, E. A., Jr. 00552

00535 **Schultz, C. Bertrand; Tanner, Lloyd G.; Whitmore, Frank C.; Ray, L. L.** Geologic and faunal evidence of the Quaternary deposits at Big Bone Lick, Kentucky [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 24-25, 1969.

06520 **Scolaro, Reginald Joseph.** Paleoecology of the Bryozoa of the Chipola Formation, Clarksville area, Florida [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2141B, 1968.

06671 **Scott, Glenn R.** Geologic and structure contour map of the La Junta quadrangle, Colorado and Kansas: U.S. Geol. Survey Misc. Geol. Inv. Map I-560, scale 1:250,000, 1968.

00536 **Scott, Robert W.** Sedimentary environments of Lower Cretaceous rocks, southern western interior [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 25, 1969.

00537 **Scott, Robert W.** Biostratigraphy of Lower Cretaceous rocks, southern western interior [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 25-26, 1969.

00538 **Scott, Robert W.** Kansas Precambrian structures and their influence upon younger structures [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 26, 1969.

00519 **Sebby, Wade S.; Matten, Lawrence C.** *Kalymma minuta* (Read) comb. nov. from the New Albany Shale: Torrey Bot. Club Bull., v. 96, no. 1, p. 79-88, illus., 1969.

The holotype of *Arnoldella minuta* Read, 1936 from the Falling Run member of the Sanderson formation, probably earliest Mississippian in age, at Junction City, Ky., is found to have features not previously described: a single-layer epidermis; outer cortex of the sparganum type; xylem cells with scalariform thickenings; and terete appendage traces, one per appendage, the appendages probably opposite. A second specimen, collected by Sebby and Matten from the same horizon and locality, shows also that: the adaxial surface of the axis had a groove; the "lysigenous" areas of Read were ovoid cavities; and the sclerenchymatous strands in the outer cortex anastomosed. *A minuta* falls within the range of variation of *Kalymma*, a calamopityean petiole genus, and is transferred to that genus.—VMJ

00361 **Semken, Holmes A.** Paleoecological implications of micromammals from Peccary Cave, Newton County, Arkansas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 27, 1969.

Sen Gupta, Barun K. *See* Schafer, Charles T. 089

06748 **Serratosa, J. M.** Infrared study of benzonitrile (C_6H_5-CN)-Mont—The morillonite complexes: Am. Mineralogist, v. 53, nos. 7-8, p. 1244-1251, illus., 1968.

Infrared absorption stujy of the Mg-saturated montmorillonite complex with benzonitrile shows when compared with Ca- and Ba-saturations that the benzonitrile molecules coordinate regularly about the exchangeable ions. The array of the benzonitrile ligands as for the square hybrid complex, holds water to complete the octahedron in proportion to the polarizing strength of the metal-ion.—Author's abstract

Shaffer, Bernard. *See* Manes, Monna. 00525

Shaffer, Bernard L. *See* Hepner, Beverly J. 00396

06360 **Shafiqullah, M.; Tupper, W. M.; Cole, T. J. S.** K–Ar ages on rocks from the crater at Brent, Ontario: Earth and Planetary Sci. Letters, v. 5, no. 3, p. 148–152, illus., tables, 1968.

The genesis of the fossil crater at Brent is a stimulating contemporary geological debate. Meteorite impact and endogenetic models are being considered. Geological evidence suggests that the crater formed 475 to 750 m.y. ago. One K/Ar age determination on alnöite from the crater has an age of 576 ± 40 m.y. Dates on four rock samples described as microsyenites or "melt rocks" from below the crater fall between 310 and 365 m.y. If the crater formed earlier than 475 m.y. ago, these young ages could be the result of younger hydrothermal alteration although the rocks themselves do not support this interpretation. If the apparent ages are true ages, the microsyenites have formed significantly later than the crater and cannot be "melt rocks" formed by meteorite impact.—Authors' abstract

06559 **Shah, Syed Mohammad Ibrahim.** Stratigraphic paleobotany of the Weiser area, Idaho [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2091B–2092B, 1968.

00616 **Shannon, R. D.; Prewitt, C. T.** Coordination and volume changes accompanying high-pressure phase transformations of oxides: Materials Research Bull., v. 4, no. 1, p. 57–62, table, 1969.

Although attention has always been given to changes of cation coordination in high-pressure phase transformations, changes of anion coordination have generally been ignored even though they are as characteristic and probably as important as those of the cations. The importance of the anion coordination change is illustrated for transformations of In_2O_3 and the transition metal molybdates. The relative change of molar volume or density can frequently be used to distinguish high-pressure phase transformations involving a coordination change from those not involving a coordination change.—Authors' abstract

00380 **Sharp, Robert P.** Semiquantitative differentiation of glacial moraines near Convict Lake, Sierra Nevada, California: Jour. Geology, v. 77, no. 1, p. 68–91, illus., tables, 1969.

The moraines were tested by semiquantitative methods of age differentiation based on surface-boulder frequency, weathering of granitic surface boulders, grain-size distribution, and color and pH of soils. The resultant data, supplemented by field evidence, indicate that moraines previously assigned in part to glaciations as old as the early Pleistocene Sherwin are of late Pleistocene Tahoe and Tioga age. No Sherwin deposits were recognized near Convict Lake. The methods were not effective for differentiation of the type Sherwin till from the possibly older McGee till.—DRM

00482 **Shepard, F. P.; Dill, R. F.; VonRad, Ulrich.** Physiography and sedimentary processes of La Jolla submarine fan and fan-valley, California: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 390–420, illus., table, 1969.

La Jolla canyon is narrow and rock-walled but changes seaward to a wider valley cut into the clayey sediments of a fan. The fan-valley merges into the San Diego trough. The floor of the channel in the fan-valley has been little disturbed in recent years. Most of the sediment deposited on the valley floor in the past few thousand years consists of clayey silt, underlain by discontinuous layers of fine-grained sand. Cores from the fan contain less sand. Evidence indicates that sand has been carried along the valley axes; however, there is little evidence of recent high-velocity turbidity currents. The sand was probably introduced by a traction type of pulsating current. Stronger currents probably moved down the valley during the Pleistocene.—EAM

Sherman, John W., 3d. *See* Zaitzeff, James B. 06405

00626 **Shier, Daniel E.** Vermetid reefs and coastal development in the Ten Thousand Islands, southwest Florida: Geol. Soc. America Bull., v. 80, no. 3, p. 485–507, illus., 1969.

Sediments under the Ten Thousand Islands were deposited over the past 5,000 years, during continuous marine transgression. Sediment thickness is 25 feet. Macrofauna and microfauna were used to interpret depositional environment. Marine waters entered the area 3,000 years ago, and gastropod reefs appeared along the coastline. During sea level rise of six feet, reefs have grown in size and number to form a reef barrier which greatly influenced sedimentation throughout the Islands. Reefs were formed by sessile gastropod *Vermetus (Thylaeodus) nigricans* Dall. Reef core consists of fused vermetid tubes in calcareous silt. Reef rock was confined to the intertidal zone, a vertical distance of four feet. Vermetid reefs are compared with post-Wisconsin serpulid reefs, Laguna Madre, Texas, and with rudistid reefs of the Edwards Limestone, Texas.—*from* Author's abstract

Short, James M. *See* Muffler, L. J. Patrick. 00477

06480 **Shreve, Ronald L.** Sherman slide, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 395–401, illus., tables, reprinted 1968; originally published 1966.

This paper is reprinted with minor changes from Science, v. 154, no. 3757, p. 1639–1643, 1966. *See* Abstracts of North American Geology for June 1967.—MCM

06542 **Shull, Roger Don.** Radioactivity transport in water—Simulation of sustained releases to selected river environments [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2062B–2063B, 1968.

06668 **Sigma Gamma Epsilon.** 1968 national convention, Cincinnati, Ohio—Handbook and guidebook: Cincinnati, Ohio, Sigma Gamma Epsilon, Alpha Delta Chapter, [79] p., illus., 1968.

Included here are historical summaries of the two co-host chapters of Sigma Gamma Epsilon—Alpha Delta, University of Cincinnati, and Alpha Theta, Miami University—and the following geological sections: Cincinnatian stratigraphy in the vicinity of Cincinnati, including correlation chart and fossil assemblages, with road logs for the Kope-Maysville strata and Ordovician biostratigraphy; and the Richmond Group—Upper Ordovician strata, with a road log of the Oxford, Ohio, area. A reprint from the Geol. Soc. America Guidebook of the Cincinnati region, 1961, of a paper by R. H. Durrell, on the Pleistocene geology of the Cincinnati region, with road log slightly altered, is cited separately.—GDC

06506 **Simons, Elwyn L.** New fossil primates—A review, [Chap.] 3 *in* Perspectives on human evolution, V. 1 (S. L. Washburn and Phyllis C. Jay, editors): New York, Holt, Rinehart and Winston, p. 41–60, illus., tables, revised 1968; originally published 1960.

Significant new fossil primate finds in the Old and New Worlds over the past 20 years are reviewed, with emphasis on nearly complete skulls and postcranial remains belonging to species previously known only from jaws and teeth. These are discussed by epochs, from Paleocene through Pleistocene. In North America, the lower primates, Prosimii, are represented by the Paleocene *Palaechthon* (R. W. Wilson, unpublished); the Eocene *Notharctos* and *Smiladectes* (Gazin, 1958, 1965), *Phenacolemur* (Simpson, 1955), *Microsypos* (McKenna, 1966), and others. Occurrences of *Phenacolemur* and *Plesiadapis* in both Old and New Worlds demonstrate that in late Paleocene, or before, climate and land bridges made possible a Holarctic distribution for some primates.—VMJ

00585 **Sine, N. M.; Taylor, W. O.; Webber, G. R.; Lewis, C. L.** Third report of analytical data for CAAS sulfide ore and syenite rock standards: Geochim. et Cosmochim. Acta, v. 33, no. 1, p. 121–131, tables, 1969.

New analyses are presented for two standard references samples, a sulfide ore and a syenite rock, that were prepared and issued by the Nonmetallic Standards Committee of the Canadian Association for Applied Spectroscopy (now Spectroscopy Society of Canada) in 1961. Revised mean and median values and the number of determinations used in the calculation of these values are also presented. The supply of syenite rock has been exhausted but two new syenite rock standards are to be issued.—Authors' abstract

Skidmore, W. Brian. *See* Ayrton, William G. 00625

Slaughter, M. *See* Merkle, A. B. 06766

06699 **Sliter, William V.** Upper Cretaceous Foraminifera from southern California and northwestern Baja California, Mexico: Kansas Univ. Paleont. Contr. [49], Protozoa, art. 7, 141 p, illus., tables, 1968.

Localities at Carlsbad, La Jolla, Point Loma, Calif., and Punta Descanso, Mexico, have yielded 274 species of 106 genera and 38 families; 38 species, 3 genera, and a subfamily are new. Three assemblage zones are proposed: *Globotruncana rosetta* Zone, middle to late Campanian; *G. mariei*, late Campanian; *Rugoglobigerina rugosa*, early Maestrichtian; these are correlated essentially by 32 planktonic and 8 specialized benthonic species. Two distinct biofacies, inner shelf at Carlsbad, bathyal at the other localities, transgress zonal boundaries. Four Late Cretaceous planktonic zones are postulated along the Pacific coast: equatorial, south-central (this area, with strong Tethyan affinities), north-central, northern; these are remarkably similar to the present zones.—VMJ

00588 **Sloss, Laurence L.** The next 20 years: Geotimes, v. 14, no. 2, p. 20, 22, 1969.

The American Geological Institute passed its 20th anniversary in Nov. 1968. Now scientists need to decide whether it should continue in its present form, undergo significant change, or be terminated. Sloss finds the first and third alternatives unacceptable. Functions of the AGI that must be performed are: government supported activities, communication among geological scientists and their societies, services for member societies and for geological sciences, such as publications, and public and government relations. Too much money goes to the first of these. The projects are good, but the other categories are what AGI should really be about, especially 3 and 4. The American Institute of Physics publishes all journals of member societies and also handles all billing, list maintenance, etc. The major obstacle to cooperation among AGI societies is the belief of their officers that their society is most important.—ESL

Smerdon, Ernest T. *See* Barfield, Billy J. 00496

Smiley, Terah L. *See* Stokes, Marvin A. 06656

Smith, Avery E. *See* Goudarzi, Gus H. 06672

00379 **Smith, J. Dungan.** Geomorphology of a sand ridge: Jour. Geology, v. 77, no. 1, p. 39-55, illus., tables, 1969.

Middle Ground, a sand ridge in Vineyard Sound, Mass., is in dynamic equilibrium with the tidal current system, and large-scale morphological changes occur only over periods of several years. The sand waves that cover the ridge are completely to partly rebuilt during half a tidal cycle, however, and the net movements of the sand waves are consistent with the counterclockwise circulation of water around the ridge. The sand in the ridge was eroded from the adjacent Lucas Shoal, which is composed of glacial drift, deposited by long shore currents, and reshaped by tidal currents. The Middle Ground-Lucas Shoal system now appears to be isolated, accepting no sediment from surrounding areas and contributing only minor amounts of sediment to the surrounding sea floor.—ETR

Smith, J. R. *See* Lehr, J. R. 06379

Smith, J. V. *See* Bennett, J. M. 00617

Smith, J. V. *See* Birle, J. D. 06460

06767 **Smith, J. V.** The crystal structure of staurolite: Am. Mineralogist, v. 53, nos. 7–8, p. 1139–1155, illus., tables, 1968.

Staurolite [a 7.8713(24), b 16.6204(26) c 5.6560(11), β 90°, C2/m] is pseudo orthorhombic. Although the structure (alternating layers of kyanite and $AlFe_2O_2OH$) given by Naray–Szabó and Sasvári (1958) is basically correct, the details are more complex. Two new octahedral sites U(1) and U(2) at (0.5,0,0) and (0.5,0,0.5) are weakly occupied in a specimen from St. Gotthard; the U(1) and U(2) octahedra share faces with the Fe tetrahedron, and the indicated low occupancy of the latter might be explained by prohibition of simultaneous occupancy of the octahedra.—*from* Author's abstract

00449 **Smith, Joseph Blake.** Strippable coal reserves of Montana, North Dakota, and Wyoming [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 214, 1969.

00362 **Smith, Michael A.** Selectivity of adventitious test material by *Reophax curtus* (Foraminiferida) [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 28, 1969.

06601 **Smith, Norman D.** Cyclic sedimentation in a Silurian intertidal sequence in eastern Pennsylvania: Jour. Sed. Petrology, v. 38, no. 4, p. 1301–1304, illus., 1968.

At Schuylkill Gap in eastern Pennsylvania, cycles composed of (1) a basal erosional surface overlain by a thin coarse-grained deposit, (2) a lower greenish-olive interlaminated sandstone and shale member, and (3) an upper burrow-mottled red argillaceous siltstone member occur through two portions of a thick section of the Clinton Formation. The sediments were deposited in an intertidal zone and are believed to represent alternating deposits of high tidal flats and either tidal creek channels or low tidal flats.—Author's abstract

00693 **Smith, P. J.** Geophysics policy—A select, annotated bibliography: Earth-Sci. Rev., v. 4, no. 3, p. A173–A186, 1968.

This bibliography covers material within the broad range of geophysics policy, published between 1 January 1967 and 31 March 1968. 'Geophysics policy' has been liberally defined to include items of relevance to geophysics whether or not they are concerned with geophysics per se.—Author's summary

00510 **Smith, Richard E.** Petrography–porosity relations in carbonate–quartz system, Gatesburg Formation (Late Cambrian), Pennsylvania: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 261–278, illus., tables, 1969.

The Gatesburg Formation of Late Cambrian age in central Pennsylvania consists of cyclic deposits of nearly pure dolomite to nearly pure quartzite. Analyses of size, shape, sorting, and packing indicate that degree of packing is the primary property influencing intergranular porosity, and accounts for 36 percent of total variation of porosity. Component analyses show that carbonate and quartz are significantly related to each other or associated with common causes. Development of intergranular porosity is related casually to a quartz-grain-supported framework where the quartz–carbonate ratio is greater than 1:1. Statistically significant correlations were found between packing and amount of quartz, packing and porosity, and amount of quartz and porosity. Intergranular porosity is not related to grain size. Permeability values of sandstones and quartzites are several orders of magnitude higher than dolomite.—*from* Author's abstract

06497 **Smith, Robert L.; Bailey, Roy A.** Resurgent cauldrons, *in* Studies in volcanology—A memoir in honor of Howel Williams: Geol. Soc. America Mem. 116, p. 613–662, illus., tables, 1968.

Resurgent cauldrons are calderas in which the cauldron block, following subsidence, has been uplifted, usually as a structural dome. Using the Valles caldera, New

Mexico, as a model, augmented by information from other cauldrons, seven stages of events are recognized: regional tumescence and generation of ring fractures; caldera-forming eruptions; caldera collapse; preresurgence volcanism and sedimentation; resurgent doming; major ring-fracture volcanism; terminal solfatara and hot-spring activity. Evidence indicates that resurgent doming is early in postcollapse history, hence, is part of a pattern and not fortuitous. Doming of the block by magma pressure is preferred to doming by stock or laccolithic intrusion. Genetically, resurgent cauldrons belong to a group in which subsidence takes place along ring fractures and is related to eruption of voluminous ash flows.—*from* Authors' abstract

Smith, Robert L. *See* Doell, Richard R. 06579

00363 **Smith, Steven V.; Dygas, Joseph A.; Chave, Keith E.** Distribution of calcium carbonate in pelagic sediments [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 28, 1969.

Smith, Vertie C. *See* Muffler, L. J. Patrick. 00477

Smith, Wayne E., Jr. *See* Blackwell, Phillip W. 00593

Smith, William L. *See* Ross, Malcolm. 06568

00518 **Solt, M. W.; Wahlberg, J. S.; Myers, A. T.** Determination of rhenium in molybdenite by X-ray fluorescence—A combined chemical-spactrometric technique: Talanta, v. 16, no. 1, p. 37-43, illus., tables, 1969.

Rhenium in molybdenite is separated from Mo by distillation of Re heptoxide from a perchloric-sulfuric acid mixture. It is concentrated by precipitation of the sulfide and then determined by X-ray fluorescence. From 3 to 1000μg of Re can be measured with a precision generally within two percent. The procedure tolerates larger amounts of Mo than the usual colorimetric methods.—Authors' abstract

06522 **Spalding, Joe S.** Lithology determination from the Micro-Seismogram: Log Analyst, v. 9, no. 4, p. 3-7, illus., 1968.

The location and identification of lithology changes has been effected by use of the Micro-Seismogram Log. Conspicuous phasing patterns caused by the interaction of compressional and shear energy of the acoustical signal have been observed to be associated with particular lithologies. Patterns caused by relatively slow shear energy have been correlated to anhydrite and limestone lithologies while relatively fast shear energy has been correlated to chert and dolomite lithologies. The correlations were made using standard Micro-Seismogram logs recorded in open and *cased* holes located in the Permian Basin. Examples showing abrupt and gradational lithology changes are presented for limestone-dolomite, limestone-chert, limestone-sand, and dolomite-anhydrite. Use of the phasing patterns in single and dual lithologies to predict matrix transit time is discussed.—Author's abstract

00364 **Spall, Henry.** The Precambrian and paleomagnetic correlations [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 29, 1969.

06630 **Spence, W. J.; Alexander, S. S.** A method of determining the relative location of seismic events [abs.]: Earthquake Notes, v. 39, nos. 3-4, p. 13, 1968.

06540 **Squarer, David.** An analysis of relationships between flow conditions and statistical measures of bed configurations in straight and curved alluvial channels[abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2048B-2049B, 1968.

00365 **Srivastava, Satish K.** Palynologic paleoenvironment of the Edmonton Formation (Maestrichtian), Alberta, Canada [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 29, 1969.

00604 **Stanley, D. J.** Atlantic continental shelf and slope of the United States—Color of marine sediments: U.S. Geol. Survey Prof. Paper 529-D, p. D1-D15, illus., tables, 1969.

The colors of the upper sediment layer on the Atlantic continental margin between Nova Scotia and southern Florida are predominantly brown, dark green, and yellow on the shelf north of Cape Hatteras, N. C., and mostly olive, gray, and yellow to the south. Major belts of color generally trend subparallel and even transverse to the coast. With few exceptions, the color patterns correlate locally with compositional properties of the sediment rather than with either topography or texture. Color patterns on the continental slope and rise and on the Blake Plateau, unlike those on the shelf, are arranged in linear belts that trend parallel or subparallel to the shelf break. Major trends vary directly with depth and are probably related to the oxidation-reduction potential of the environment.—JHT

06593 **Stanley, Daniel J.** Reworking of glacial sediments in the North West Arm, a fjord-like inlet on the southeast coast of Nova Scotia: Jour. Sed. Petrology, v. 38, no. 4, p. 1224-1241, illus., 1968.

The present sediment distribution in the Arm conforms closely with the morphological features and with patterns of current flow. The original Pleistocene diamictite till deposits have been mechanically reorganized during the period following submergence of the former glaciated valley. The formation of gravel pavements in areas strongly affected by currents and fine-grained material on less current-agitated bottoms are characteristic. Intermediate sediment types, gradational between the original till and the better sorted mud and gravel end members, clearly do not fall in either relict or modern sediment categories as usually defined. The patchy nature of the sediment distribution and the wide range of textural types are characteristics common to submerged coastal embayments and shelves off glaciated regions in general.—*from* Author's abstract

Steacy, H. R. *See* Prest, V. K. 00598

Steinbrecher, D. H. *See* Ewen, H. I. 06394

Stewart, Richard J. *See* Dickinson, William R. 00618

Stewart, Wilson N. *See* Ramanujam, C. G. K. 00515

06398 **Stingelin, Ronald W.** Invited comments—Line scan devices and why to use them, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 103-105, illus., 1968.

Signal processing problems in terrain science work can be solved by eliminating AC averaging effects either by DC restoration or DC coupling and the prevention of saturation in the amplifier with signal limiting techniques.—GWL

00366 **Stitt, James H.** Latest Cambrian and earliest Ordovician trilobites, western Arbuckle Mountains, Oklahoma [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 30, 1969.

00467 **Stitt, James Harry.** Late Cambrian and earliest Ordovician trilobites, Timbered Hills and lower Arbuckle Groups, western Arbuckle Mountains, Murray County, Oklahoma [abs.]: Oklahoma Geology Notes, v. 29, no. 1, p. 18-19, 1969.

06656 **Stokes, Marvin A.; Smiley, Terah L.** An introduction to tree-ring dating: Chicago and London, Univ. Chicago Press, 73 p., illus., 1968.

Through photographs and commentary the authors explain the principles of tree-ring dating (dendrochronology), and detail the steps of the process from the time a sample is collected to the time it is dated and incorporated into a master chronology. The necessity of collecting samples systematically and recording field data efficiently is stressed. Although any trees that add annual rings can be used, the book concentrates on coniferous evergreens of the American Southwest. A bibliography is included at the end to point the way to broader knowledge.—ESL

Stott, D. F. *See* Taylor, G. C. 06697

Stott, D. F. *See* Taylor, G. C. 06757

Strimple, Harrell L. *See* Moore, R. C. 00529

00595 **Stromquist, Arvid A.; Sundelius, Harold L.** Stratigraphy of the Albemarle Group of the Carolina slate belt in central North Carolina: U.S. Geol. Survey Bull. 1274-B, p. B1-B22, illus., table, geol. maps, 1969.

The volcanic sedimentary rocks of the Albemarle Group in the Carolina slate belt in central North Carolina can be divided, from oldest to youngest, into the Tillery, Cid, and Millingport Formations. The Cid Formation is divided into a lower mudstone member and an upper unit, the Flat Swamp Member. The Millingport Formation is divided into the Floyd Church Member and the overlying Yadkin Member. All formations contain mafic and felsic volcanic rocks, andesitic basalt, and felsic rocks intermediate in composition between rhyolite and rhyodacite. Sedimentary rocks interbedded with the volcanics include siltstone, claystone, shale, and mudstone. An Ordovician(?) age is favored for the Albemarle Group. The Tater Top Group, previously thought to overlie the Albemarle Group in angular unconformity, apparently does not exist. Rocks previously assigned to the Tater Top are volcanic rocks within the Albemarle Group and the underlying Uwharrie Formation.—ACS

Strunz, H. *See* Newesely, H. 06378

06719 **Sturm, Rolland G.; Kaarsberg, Ernest A.** A deep-sea geophysical exploratory manned mobile submersible (deep-sea GEMMS) and its related programs, *in* Marine sciences instrumentation, V. 4—Instrument Soc. America Symposium, 4th Natl., Cocoa Beach, Fla., 1968, Proc.: New York, Plenum Press, p. 457-471, illus., 1968.

Described are deep submersibles with a panoramic view command unit, of all-glass flat triangles, carried by a quadri-tubular titanium craft comprised of propellant tanks, buoyancy chambers, and high-pressure helium spheres. Regeneratively cooled jet engines using hypergolic fuels propel the craft. Features include telechiric manipulators and life support for four crewmen. Lifting capacities exceed 30 tons at a 15,000-ft depth. This instrument/craft should enable significant advances in Earth sciences, including the establishment of a world-wide geodetic system based upon physical geodesy cooperating with Earth-orbiting-satellite and surface-craft geodesy. Oceanographic exploration using a world-wide network of sea-floor scientific stations is feasible.—Authors' abstract

06538 **Su, Hon-Hsieh.** A study on flow through porous medium [abs.] Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2033B, 1968.

00382 **Subba Rao, S.** The terminology of oligoclase-basalt and mugearite: Jour. Geology, v. 77, no. 1, p. 101-102, 1969.

The current usage of the terms "oligoclase-basalt" and "mugearite" is discussed. Subba Rao prefers to retain both terms as representing two distinct types of oligoclase-basalt differing in chemical, textural, and mineralogic characteristics.—VSN

Sudarsanan, K. *See* Young, R. A. 06375

Sundelius, Harold L. *See* Stromquist, Arvid A. 00595

Sutherland, Alex J. *See* Bonham-Carter, G. F. 06789

06623 **Swanson, F. J.** Transport of pebbles by algae, East Parrsboro Harbour, Nova Scotia [abs.]: Maritime Sediments, v. 4, no. 2, p. 56, 1968.

Sykes, Lynn. *See* Oliver, Jack. 06635

00462 **Szabo, Ernest.** Structural evolution of Paradox basin, Four Corners area [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 219, 1969.

Tanner, Lloyd G. *See* Schultz, C. Bertrand. 00535

00513 **Tate, James, Jr.; Martin, Larry D.** A Canada Goose from the Middle Pleistocene of Nebraska: Condor, v. 71, no. 1, p. 81, 1969.

A Canada Goose, *Branta canadensis*, was collected from the Sappa Formation of late Kansan age in Nebraska.—KAF

Taylor, Charles M. *See* Radtke, Arthur S. 00605

06697 **Taylor, G. C.; Stott, D. F.** Maxhamish Lake, British Columbia (94–O): Canada Geol. Survey Paper 68–12, 23 p., table, geol. map, 1968.

Strata, ranging in age from Mississippian to late Cretaceous and having an aggregate thickness in excess of 9,000 feet, are described. Oldest rocks exposed are carbonates of the Mississippian Flett Formation which are overlain by the erosional remnant of the Mississippian Mattson Formation consisting of sandstone. The Lower Cretaceous Fort St. John Group, comprising the Buckinghorse, Sikanni, and Sully Formations, unconformably overlies the Paleozoic strata. Upper Cretaceous strata, that occur mainly in the western half of the area, are included in the Dunvegan, Kotaneelee, and Wapiti Formations. The map-area lies wholly within the Interior Plains physiographic province; nevertheless the bedrock has been deformed into several structures similar to those of the more mountainous areas to the west and north.—*from* Authors' abstract

06757 **Taylor, G. C.; Stott, D. F.** Fort Nelson, British Columbia (94J): Canada Geol. Survey Paper 68–13, 23 p., table, geol. map, 1968.

Late Devonian to Late Cretaceous strata, having an aggregate maximum thickness of 10,800 feet, are described. Approximately 3,400 feet of Paleozoic strata have been subdivided into four formations which are, in ascending order, the Besa River, Prophet, Kindle, and Fantasque Formations. These are overlain by 2,100 feet of Triassic strata comprising the Grayling, Toad, and Liard Formations. The Lower Cretaceous Gething Formation and the Fort St. John Group, 800 feet thick and 4,500 feet thick, respectively, overlie the Triassic rocks. The succession is capped by the Late Cretaceous Dunvegan Formation, about 500 feet thick, and locally, by the younger Kotaneelee Formation. The map-area lies within the Interior Plains and Rocky Mountain Foothills structural provinces.—*from* Authors' abstract

00492 **Taylor, George S.; Luthin, James N.** Computer methods for transient analysis of water-table aquifers: Water Resources Research, v. 5, no. 1, p. 144–152, illus., 1969.

The drawdown in a pumped unconfined aquifer can be analyzed by computer methods. The computer can give simultaneous solutions for flow in the saturated and unsaturated zone. The surface of seepage can also be included in the analysis.—Authors' abstract

Taylor, W. O. *See* Sine, N. M. 00585

00367 **Terasmae, J.** Facts, fiction, and faith in Quaternary palynology [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 30–31, 1969.

06643 **Thomas, Barbara; Tuttle, Sherwood D.** Differentiation of drift topographies by statistical analysis of slope data: Iowa Acad. Sci. Proc. 1967, v. 74, p. 147–159, illus., tables, 1968.

The purpose of this study is an investigation of slope development by statistical analysis of slope angle, slope length, relief and stream gradient data developed on four different glacial drift deposits in Iowa. Measurements from randomly selected points on 1:24,000 topographic maps provide the data. Analysis of variance is used with both F-ratios and between-group t-tests. Differences from comparisons based

on the age of the different glacial drifts were found to be significant for all parameters. Significant differences were also found for some of the variables in comparisons based on physiographic classification, stream order of the nearest stream, and orientation of the slope. Relationships among the variables are indicated by correlation coefficients with significance determined by t-tests.—Authors' abstract

Thompson, Gary G. *See* Cross, Aureal T. 00403

06600 **Thompson, Geoffrey; Bowen, V. T.; Melson, W. G.; Cifelli, Richard.** Lithified carbonates from the deep-sea of the equatorial Atlantic: Jour. Sed. Petrology, v. 38, no. 4, p. 1305–1312, illus., tables, 1968.

A wide variety of lithified carbonates has recently been found in the deep sea of the equatorial Atlantic. These include partially lithified foraminiferal oozes, foraminiferal limestones, tuffaceous limestones, completely recrystallized limestones, and dolostones. No correlation was observed between paleontological age and degree of lithification. The close spatial association of such diverse carbonate rocks on the ocean floor appear to indicate very local variations in the geochemical conditions for carbonate lithification. The relative infrequency of reports of such rocks from the deep sea probably represents inadequate sampling rather than a real rarity of lithified carbonates in the upper suboceanic crust.—Authors' abstract

06709 **Thompson, R. N.; Patrick, D. J.** Folding and slumping in a layered gabbro: Geol. Jour., v. 6, pt. 1, p. 139–146, illus., 1968.

The layered gabbroic intrusion of Sarqata qaqa, Ubekendt Ejland, West Greenland, contains numerous xenoliths of thermally metamorphosed picrite-basalt. Folding and slumping of the layering occurs adjacent to some of these blocks. It is postulated that the structures were formed by stoped lava xenoliths hitting the unconsolidated layers of crystals forming the floor of the magma chamber during the cooling history of the intrusion. The settling velocities of the xenoliths, and the thickness and viscosity of the crystal mush are estimated and discussed.—Authors' abstract

Thompson, Thomas L. *See* Goebel, Edwin D. 06373

06570 **Thorsteinsson, R.; Kerr, J. William.** Cornwallis Island and adjacent smaller islands, Canadian Arctic Archipelago: Canada Geol. Survey Paper 67-64, 16 p., tables, geol. map, 1968.

Five concordant rock successions separated by regional unconformities crop out in this area near the central Canadian Arctic Archipelago: Lower Ordovician to Lower Devonian marine carbonates, clastics, and evaporites totaling 21,000 feet in thickness constitute the preponderance of bedrock; Lower Devonian red beds and equivalent marine carbonates; Middle Devonian marine carbonates and clastics; Upper Devonian marine clastics; and Upper Cretaceous and Lower Tertiary nonmarine clastics. The oldest succession was deposited in the Franklinian miogeosyncline, and subsequent ones as thin, stable-platform sediments preserved in grabens, synclinal troughs, and along downfaulted sides of normal faults. Regional unconformities mark successive tectonic movements of the Cornwallis fold belt.—*from* Authors' abstract

06465 **Tieu, Pei-Lin.** Hydrobasaluminite and basaluminite in Cabaniss Formation (Middle Pennsylvanian), southeastern Kansas: Am. Mineralogist, v. 53, nos. 5–6, p. 722–732, illus., tables, 1968.

Hydrobasaluminite is associated with gypsum and iron oxides and occurs above a Pennsylvanian coal. Basaluminite is found only as debris on dry slopes. Basaluminite changes to metabasaluminite between 75°C and 330°C, but samples heated below 200°C partly or completely rehydrate upon cooling. The chemical composition of basaluminite is approximately $2Al_2O_3 \cdot SO_3 \cdot 10H_2O$; composition of hydrobasaluminite is questionable. Differential thermal analyses of hydrobasaluminite show endothermic peaks at 155°, 220°, 355°, 890°, and 940°C. Basaluminite has endothermic peaks at 125°, 170°, 220°, 355°, and 940°C. Infrared

spectra of basaluminite in the range 400 to 4000 cm^{-1} show typical sulfate absorption bands from 580 to 690 cm^{-1} and 1050 to 1200 cm^{-1}.—*from* Author's abstract

00561 **Tilling, R. I.; Greenland, L. Paul; Gottfried, David.** Distribution of scandium between coexisting biotite and hornblende in igneous rocks: Geol. Soc. America Bull., v. 80, no. 4, p. 651–668, illus., tables, 1969.

Distribution coefficient for scandium, $K_d = Sc_{hornblende}/Sc_{biotite}$, was determined in about 90 plutonic and volcanic rocks from various provinces, including Southern California, Boulder, Sierra Nevada and Boulder Creek batholiths and the Jemez Mountains volcanic rocks. This study shows that (1) K_d closely approaches that of equilibrium distribution, (2) K_d is not related to the mode of crystallization (plutonic, hypabyssal, volcanic), (3) K_d for igneous rocks is higher than that for metamorphic rocks, (4) validity of so-called scandium geothermometer is questioned.—AH

06523 **Timur, A.** An investigation of permeability, porosity, and residual water saturation relationships for sandstone reservoirs: Log Analyst, v. 9, no. 4, p. 8–17, illus., tables, 1968.

Possibilities were tested through laboratory measurements for establishing an accurate relationship to estimate permeability of sandstones from in-situ measurements of porosity and residual fluid saturation. Measurements were made of the permeability (K), porosity (ϕ), and residual water saturation (S_{wr}) on 155 sandstone samples from three oil fields in North America. Results indicate that the empirical equation $K = 0.136 \cdot \phi^{4.4}/S^2_{wr}$ is the best estimator of permeability and that $S_{wr} = 3.5 \cdot \phi^{1.26}/K^{0.35} - 1$ is best for estimating residual water saturation.—VSN

00479 **Tinkler, Keith J.** Trend surfaces with low "explanations"—The assessment of their significance: Am. Jour. Sci., v. 267, no. 1, p. 114–123, illus., tables, 1969.

Howarth has given some limits below which the percentage reduction in the sum of the squares on trend surfaces may be generated by purely random data. This paper offers some qualitative and quantitative approaches which may be used to assess the significance of trend surfaces when the percentage reduction in the sum of squares falls close to, or below, the limits recommended by Howarth. The problem is discussed in terms of a field example that gave rise to such difficulties.—Author's abstract

06513 **Tixier, M. P.; Morris, R. L.; Connell, J. G.** Log evaluation of low-resistivity pay sands in the Gulf Coast: Log Analyst, v. 9, no. 6, p. 3–20, illus., 1968.

Gulf Coast pay sands are not always identifiable on resistivity logs, but a combination of resistivity and porosity log can solve most problems. When the three types of porosity logs—sonic, density, and neutron—are available, determination of effective porosity and shale content, and distinction between gas and oil are possible. Resistivity values then provide a reasonable estimation of water saturation. If no gas is present, a density log with either sonic or neutron will permit estimation of porosity and shaliness. The combination of sonic and resistivity data incorporated in the R_{wa} log is effective in finding gas or oil pay zones. The combination resistivity-density is not effective in shaly sands. Quantitative evaluations in shaly sands are best handled by computer.—VSN

06737 **Todd, Thomas W.; Monroe, William A.** Petrology of Domengine Formation (Eocene), at Potrero Hills and Rio Vista, California: Jour. Sed. Petrology, v. 38, no. 4, p. 1024–1039, illus., tables, 1968.

That part of the Domengine Formation in the deeper parts of the Sacramento Valley basin accumulated under predominantly transgressive marine conditions. Major textural varieties of this feldspathic subgraywacke unit in the Potrero Hills–Rio Vista area include clayey sandstone, sandy siltstone, and silty shale. The source of the sediments was the Sierra Nevada batholith complex and its western foothills belt of metamorphic rocks. Detrital contribution from the Coast Ranges is unsupported by conclusive evidence. Pyroclastic debris from the Sierra foothills or a western island chain comprises a third and minor source of sediments. Kaolinitic alteration

of feldspar suggests a source area of moderate relief with warm and humid climate. Five lithologic subunits are recognized.—*from* Authors' abstract

Trautz, Otto R. *See* Legeros, Racquel Z. 06377

00488 **Tucker, Delos R.** Reply [to discussion (1969) by Larry L. Jones of "Lower Cretaceous geology, northwestern Karnes County, Texas", 1968]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 437–439, illus., 1969.

Two wells cited by Jones (ibid., p. 436–437) are used to revise part of the thickness map of the Georgetown Limestone. The faults in question are still believed to be post-depositional in age. Thickening does not occur on downthrown sides of faults as it should if faulting and deposition were contemporaneous. The time of latest faulting is younger than the age of youngest rocks faulted, and the author's original opinion is believed to be valid.—SEF

00386 **Tufty, Barbara.** 1001 questions answered about natural land disasters: New York, Dodd, Mead and Co., 350 p., illus., 1969.

This book deals not only with the destructive impact of natural catastrophies, but also with underlying causes, scientific structures, patterns of behavior, and even the benefits. As far as possible, the anatomy of each is described with a basic plan of definition, cause, case history, structure, accompanying phenomena, regions, frequency, myths, methods of prevention and control, warning systems, safety rules, and research organizations. Chapter headings are: earthquakes, volcanoes, tsunamis, avalanches, landslides, floods, droughts, fires, and animal plagues. A bibliography and index are included.—MCM

Tupper, W. M. *See* Shafiqullah, M. 06360

06473 **Tuthill, Samuel J.; Field, William O.; Clayton, Lee.** Postearthquake studies at Sherman and Sheridan Glaciers, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 318–328, illus., tables, 1968.

A rock avalanche from Shattered Peak and one from Pyramid Peak fell onto Sherman Glacier during the 1964 earthquake. It is predicted that the mass of this rock and of the glacier ice the rock will conserve by insulation will affect the mass budget of Sherman Glacier so that previous recession of the terminus will be arrested and reversed; once the terminus extends beyond the point of equilibrium with local climate, it will stagnate and become colonized by plants and animals. Sheridan Glacier, not affected by an avalanche, was studied as a laboratory control. Periodic future observation of behavior of Sherman Glacier, plant population, and molluscan population will provide an unusually precise body of knowledge of processes of glacial advance and stagnation and of the response of proglacial biota.—*from* Authors' abstract

06476 **Tuthill, Samuel J.** Earthquake-triggered rock avalanches and glacial stagnation in south central Alaska, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 362–368, illus., reprinted 1968; originally published 1966.

This paper is revised and reprinted from Jour. Glaciology, v. 6, no. 43, p. 83–88, 1966. *See* Abstracts of North American Geology for August 1966.

Tuttle, Sherwood D. *See* Thomas, Barbara. 06643

Uchupi, Elazar. *See* Sanders, J. E. 00541

Udagawa, S. *See* Williams, E. G. 06595

00368 **Underwood, James R., Jr.; DeFord, R. K.** Large-scale dessication fissures in alluvium, Trans-Pecos Texas and northern Chihuahua [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 31, 1969.

00423 **U.S. Geological Survey.** Aeromagnetic map of the Norfolk quadrangle and parts of the West Torrington and South Sandisfield quadrangles, Litchfield County, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-642, scale 1:24,000, 1969.

00424 **U.S. Geological Survey.** Aeromagnetic map of the New Hartford quadrangle and parts of the Collinsville and West Granville quadrangles, Litchfield and Hartford Counties, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-644, scale 1:24,000, 1969.

00425 **U.S. Geological Survey.** Aeromagnetic map of the Tariffville quadrangle and parts of the Avon and Southwick quadrangles, Connecticut and Massachusetts: U.S. Geol. Survey Geophys. Inv. Map GP-645, scale 1:24,000, 1969.

00426 **U.S. Geological Survey.** Aeromagnetic map of the Ellington quadrangle and part of the Rockville quadrangle, Hartford and Tolland Counties, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-648, scale 1:24,000, 1969.

06711 **U.S. Geological Survey.** Radar mosaic, Yellowstone National Park: Washington, D.C., U.S. Geol. Survey, 1 sheet, 1968.

Usami, T. *See* Landisman, M. 06651

06790 **Vaca Alatorre, Alfonso.** El papel de los topógrafos en la industria minera: Geología y Metalurgía, v. 3, no. 23, p. 85–93, 1968.

Present professional status of surveyors in the mining industry of North America is reviewed and special circumstances of underground (as contrasted with above-ground) surveying are outlined. Professional status of mine surveyors has lagged behind that of both surveyors and mining engineers, for whom universities and technical institutions have complete programs; whereas courses in mine surveying are rarely included and postgraduate work in this field is practically nonexistent. In the past few years, educational programs in the U.S. and Canada are being improved, professional standards are being raised, and advances in instrumentation and techniques made over the past 15 or 20 years are being applied to mine surveying.—VMJ

Vali, V. *See* Bostrom, R. C. 00574

06673 **Vallentyne, J. R.** Pyrolysis of proline, leucine, arginine and lysine in aqueous solution: Geochim. et Cosmochim. Acta, v. 32, no. 12, p. 1353–1356, illus., 1968.

Arrhenius equations for pyrolysis in 0.01 M solution are given for proline, leucine, arginine and lysine. Ammonia was produced in all cases. Arginine gave rise to ornithine, proline and an unidentified basic compound in addition.—*from* Author's abstract

00369 **VanLandingham, Sam L.** Environments of deposition of an early diatomaceous deposit in Broadwater County, Montana [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 31–32, 1969.

06684 **VanSchmus, W. R.; Ribbe, P. H.** The composition and structural state of feldspar from chondritic meteorites: Geochim. et Cosmochim. Acta, v. 32, no. 12, p. 1327–1342, illus., tables, 1968.

Electron microprobe analysis and X-ray diffraction techniques were used to determine the chemical compositions and structural states of feldspar in recrystallized chondritic meteorites from the L, LL, H, and E groups. The feldspar is a secondary recrystallization product and is commonly partially or wholly converted to maskelynite. The feldspars are rich in Ab end-member containing small amounts of An and Or. X-ray diffraction of feldspar indicates a high intermediate structural state. Consideration of the cell angle γ puts the structural state in the high to high-intermediate range. The fact that chondritic feldspars are in the high-temperature state does not preclude cooling of these meteorites over 10^6 to 10^8 yr within asteroidal sized bodies. Observations and data are consistent

with earlier suggestions that maskelynite is produced by shock.—*from* Authors' abstract

06539 **Varrin, Robert Douglas.** Model analysis of unsteady flow to multiaquifer [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2033B–2034B, 1968.

Vedam, K. *See* Schmidt, E. D. D. 06751

00493 **Vemuri, Venkateswararao; Karplus, Walter J.** Identification of nonlinear parameters of ground water basins by hybrid computation: Water Resources Research, v. 5, no. 1, p. 172–185, illus., 1969.

Identification of parameters of an unconfined aquifer in which the dynamics of the water table are describable by a partial differential equation can be looked upon as a control system problem in distributed parameter systems. Using a maximum principle in conjunction with a steepest descent algorithm, the transmissibility of an aquifer is identified, starting from observed values of input–output as data. This algorithmic procedure is blended with a heuristic method to identify the storage coefficient and the boundary of an aquifer. Results of computations carried out on a hybrid computer for the San Fernando Valley basin, Calif., are presented.—Authors' abstract

00498 **Vilks, Gustavs.** Recent foraminifera in the Canadian Arctic: Micropaleontology, v. 15, no. 1, p. 35–60, illus., tables, 1969.

The Recent foraminifera in the ice-covered seas of the Canadian Arctic were found to be distributed in two bathymetric zones with their common boundary at about the 200-meter isobath. The information was used to support a theory of a regional lowering of sea level during the Holocene. The rate of sedimentation during the past 8,000 years is indicated to be 4.4 cm per 1,000 years.—Author's abstract

06791 **Villalobos, Crescencio Ignacio.** Nuevo método de clasificación de las aguas naturales por medio de un diagrama triangular (diagrama triangular hidroquímico) [with English abs.]: Geología y Metalurgía, v. 3, no. 23, p. 72–83, illus., 1968.

This method is proposed to classify a natural water in such a way that, according to the composition in ppm of the fundamental ions (in its quantitative aspect), it occupies only a point in one triangular diagram. The ions considered are: Ca^{++}, Mg^{++}, Na^{+}, K^{+}, Cl^{-}, SO_4^{--}, and (indirectly) HCO_3^{-}. [The diagram shown has 100 percent of Na + K, Ca + Mg, and SO_4 + Cl as its respective vertices, and is divided into 14 zones.]—Author's English abstract

06696 **Vineyard, Jerry D.; Williams, James H.** A foundation problem in cavernous dolomite terrain, Pulaski County, Missouri: Missouri Speleology, v. 10, no. 1, p. 1–14, illus., 1968.

Pulaski County is in a region underlain by cavernous Ordovician dolomite. The Jefferson City Dolomite, Roubidaux Formation, and Gasconade Dolomite crop out in the Buckhorn area. Investigation of a sinkhole in the bed of a dry valley at the downstream end of a culvert under Highway 66 showed a cave system beneath the dry valley with several vertical shafts under the compacted highway fill. Foundation problems in similar terrains may be avoided by recognition of surface indications: underfit streams, dry streambeds, poorly graded alluvium, absence of terraces, low water tables, absence of bedrock outcrops, sinkholes, and abrupt changes in valley profiles.—ESL

VonRad, Ulrich. *See* Shepard, F. P. 00482

06468 **Vorhis, Robert C.** Effects outside Alaska, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 140–189, illus., tables, reprinted 1968; originally published 1967.

This paper is reprinted with minor changes from U.S. Geol. Survey Prof. Paper 544-C, 1967. *See* Abstracts of North American Geology for November 1967. MCM

00423 **U.S. Geological Survey.** Aeromagnetic map of the Norfolk quadrangle and parts of the West Torrington and South Sandisfield quadrangles, Litchfield County, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-642, scale 1:24,000, 1969.

00424 **U.S. Geological Survey.** Aeromagnetic map of the New Hartford quadrangle and parts of the Collinsville and West Granville quadrangles, Litchfield and Hartford Counties, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-644, scale 1:24,000, 1969.

00425 **U.S. Geological Survey.** Aeromagnetic map of the Tariffville quadrangle and parts of the Avon and Southwick quadrangles, Connecticut and Massachusetts: U.S. Geol. Survey Geophys. Inv. Map GP-645, scale 1:24,000, 1969.

00426 **U.S. Geological Survey.** Aeromagnetic map of the Ellington quadrangle and part of the Rockville quadrangle, Hartford and Tolland Counties, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-648, scale 1:24,000, 1969.

06711 **U.S. Geological Survey.** Radar mosaic, Yellowstone National Park: Washington, D.C., U.S. Geol. Survey, 1 sheet, 1968.

Usami, T. *See* Landisman, M. 06651

06790 **Vaca Alatorre, Alfonso.** El papel de los topógrafos en la industria minera: Geología y Metalurgía, v. 3, no. 23, p. 85–93, 1968.

Present professional status of surveyors in the mining industry of North America is reviewed and special circumstances of underground (as contrasted with above-ground) surveying are outlined. Professional status of mine surveyors has lagged behind that of both surveyors and mining engineers, for whom universities and technical institutions have complete programs; whereas courses in mine surveying are rarely included and postgraduate work in this field is practically nonexistent. In the past few years, educational programs in the U.S. and Canada are being improved, professional standards are being raised, and advances in instrumentation and techniques made over the past 15 or 20 years are being applied to mine surveying.—VMJ

Vali, V. *See* Bostrom, R. C. 00574

06673 **Vallentyne, J. R.** Pyrolysis of proline, leucine, arginine and lysine in aqueous solution: Geochim. et Cosmochim. Acta, v. 32, no. 12, p. 1353–1356, illus., 1968.

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06468 **Vorhis, Robert C.** Effects outside Alaska, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 140–189, illus., tables, reprinted 1968; originally published 1967.

This paper is reprinted with minor changes from U.S. Geol. Survey Prof. Paper 544-C, 1967. *See* Abstracts of North American Geology for November 1967. MCM

06470 **Vorhis, Robert C.** Calculation and use of hydroseismic magnitudes, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 237–245, illus., tables, reprinted 1968; originally published 1965.

This paper is reprinted with minor changes from Ground Water, v. 3, no. 1, p. 12–20, 1965.—MCM

00370 **Voss, James D.; Brookins, Douglas G.** Channel and sheet sandstone relations near Wamego, Kansas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 32, 1969.

Vredenburgh, L. D. *See* Cheney, E. S. 06615

Wahlberg, J. S. *See* Solt, M. W. 00518

06674 **Wai, C. M.; Wetherill, G. W.; Wasson, J. T.** The distribution of trace quantities of germanium between metal, silicate and sulfide phases: Geochim. et Cosmochim. Acta, v. 32, no. 12, p. 1269–1278, illus., 1968.

Distribution of trace quantities of Ge between metal, silicate and sulfide phases of meteorites has been studied hydrothermally at controlled partial pressure of oxygen by oxygen buffer techniques. At 900°C and 500 bars, Ge is strongly siderophile in the iron–olivine system even at the equilibrium oxygen partial pressure of iron–wüstite; similar behavior of Fe is observed in the Fe–FeS system at this temperature and pressure. In the presence of the metallic ion, reduction of GeO_2 to Ge and formation of Fe–Ge alloy are spontaneous reactions. At the low Ni content of about 10 percent, as in most iron meteorites, the change in oxygen partial pressure of metal–wüstite from iron–wüstite is small and unlikely to affect siderophilic behavior of Ge. It is unlikely that a simple one-stage separation of metal from silicate would cause extremely low Ge content observed in some iron meteorites.—*from* Author's abstract

Waite, W. P. *See* Moore, R. K. 06387

06624 **Waitt, Mary Beth.** The Crane Point fan-crescent bar complex, Parrsboro Harbour, Nova Scotia [abs.]: Maritime Sediments, v. 4, no. 2, p. 56, 1968.

06525 **Walker, Barth P.** The log analyst as an expert witness in court: Log Analyst, v. 9, no. 2, p. 3–6, 1968.

The differing points of view of lawyer and scientist, the legal criteria for an 'expert witness', and pointers for the prospective expert witness on well-logging problems are discussed briefly.—VSN

00516 **Walker, Helen.** Ancient Lake Cahuilla: Desert, v. 32, no. 2, p. 24–25, illus., 1969.

The history of Ancient Lake Cahuilla and the evolution of present Salton Sea in California are discussed briefly.—KAF

Walker, Roger G. *See* Jopling, Alan V. 06733

00621 **Walker, T. R.; Honea, R. M.** Iron content of modern deposits in the Sonoran desert—A contribution to the origin of red beds: Geol. Soc. America Bull., v. 80, no. 3, p. 535–543, illus., tables, 1969.

Surface weathering on the Sonoran desert produces iron-bearing clay minerals which are concentrated in fine-grained sediments eroded from the desert. The clay fraction of the desert soils and desert-derived alluvium contains an average of about 4.5 percent total iron. An average of less than 1.0 percent iron occurs in oxide coatings on grains; the remainder is held in the clay-mineral lattices. It is inferred that under favorable interstitial chemical conditions the iron oxide coatings age to hematite and the clay undergoes postdepositional alteration, yielding additional iron which ultimately forms additional hematite pigment. It is concluded that the characteristic concentration of iron and hematite pigment in mudstones and shales

in many ancient red beds reflects initial concentration of iron-bearing clay minerals and biotite in fine-grained sediments derived from desert source areas.—*from* Authors' abstract

06489 **Waller, Roger M.** Hydrologic effects in south central Alaska, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 12–39, illus., reprinted 1968; originally published 1966.

This paper is reprinted with minor changes from U.S. Geol. Survey Prof. Paper 544-A, 1966. *See* Abstracts of North American Geology for June 1967.—MCM

06492 **Waller, Roger M.** Water-sediment ejections, *in* The great Alaska earthquake of 1964—Hydrology, Pt. A: Natl. Acad. Sci. Pub. 1603, p. 97–116, illus., table, 1968.

The 1964 earthquake produced ejections of water-saturated sediments at distances as great as 250 mi from the epicenter. Almost every valley or lowland had localized ejections that appear to have had similar controls; they consisted commonly of water containing finer-grained sediments, but gravel and cobbles were common constituents at many sites. A high water table under confined or semiconfined conditions is indicated for most occurrences. Seasonal frost confined the water table in some instances and generally localized ejections. Laboratory studies are suggested for further study of controlling features of ejection sites and their importance to human habitation and construction activities of man.—*from* Author's abstract

06510 **Ward, John R.** A study of the joint patterns in gently dipping sedimentary rocks of south-central Kansas: Kansas Geol. Survey Bull. 191, pt. 2, 23 p., illus., table, 1968.

The two most prominent joint sets have consistent orientation regardless of age of the rocks; Set I strikes northeast, Set II northwest, and both occur either as single or compound groups. Set III joints cluster around the two major sets and are subordinate in number and with less consistent orientation. Most joints studied are vertical. Sets I and II appear to be shear joints, Set III tension joints; all formed after the anticlinal folding and show no relation to subsurface faults, but are alined with the en echelon fault belt in Oklahoma. Jointing and regional tilting may be contemporaneous. The joints, post-lower Permian to pre-lower Cretaceous, may have formed as a result of north-west, horizontal, compressive forces generated by wrench-fault tectonics during initial Ouachita Mountain uplift. At least two separate but interrelated joint systems may exist in the midcontinent.—*from* Author's abstract

00371 **Warren, K. M., Jr.** Description of the "Mill Creek flora", Wabaunsee County, Kansas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 33, 1969.

Wasson, J. T. *See* Wai, C. M. 06674

06446 **Watanabe, Takashi.** The study of clay minerals by small-angle X-ray scattering: Am. Mineralogist, v. 53, nos. 5–6, p. 1015–1024, illus., table, 1968.

Small-angle scattering of X-rays by three kinds of clay minerals (allophane, hydrated halloysite and kaolinite) was observed over scattering angles from 8′ to 70′, in the range below 275 A in radius of gyration, and was analyzed by Jellinek-Solomon-Fankuchen's method for hydrated halloysite and Porod's theory. Jellinek-Solomon-Fankuchen's method for hydrated halloysite and kaolinite showed the largest value of the distribution function in the range more than 275 A in radius of gyration, but for allophane the largest value was at the smallest radius of gyration. Porod's theory was applicable to hydrated halloysite and kaolinite, but not to allophane.—*from* Author's abstract

00568 **Watkins, N. D.** Short period geomagnetic polarity events in deep-sea sedimentary cores. [abs.]: EOS (Am. Geophys. Union Trans.), v. 50, no. 2, p. 57, 1969.

Watson, Joseph A. *See* McCammon, Helen M. 00620

00539 **Watts, W. A.** A pollen diagram from Mud Lake, Marion County, north-central Florida: Geol. Soc. America Bull., v. 80, no. 4, p. 631–642, illus., 1969.

A 1360-cm profile of sediments from Mud Lake contains six pollen zones. Zone M1, at the top extends from the present back to 5070 ± 150 B.P. and represents a vegetation of sand-pine scrub, as today. Zone M2 represents a sclerophyllous oak scrub or dry forest; it is dated at 8260 ± 200 B.P. at its base. Beneath Zone M2 is a sand layer that marks a major hiatus, for the sediment immediately beneath it is over 35,000 years old. Zone M3 resembles Zone M2, so it must also reflect a warm-temperate climate, presumably of Sangamon age. Zone M4 is also assigned to the Sangamon. Zone M5 and Zone M6 represent mesic hardwood forest, tentatively assigned to the time of the Illinoian glaciation.—*from* Author's abstract

Waugh, Truman C. *See* Goebel, Edwin D. 00394

Waugh, Truman C. *See* Goebel, Edwin D. 06373

Webber, G. R. *See* Sine, N. M. 00585

06692 **Weeks, Alice D.; Eargle, D. Hoye.** Relation of diagenetic alteration and soil-forming processes to the uranium deposits of the southeast Texas Coastal Plain, *excerpts reprinted in* South Texas uranium—Corpus Christi Geol. Soc., Field Trip, 1968: Corpus Christi, Tex., Corpus Christi Geol. Soc., p. 41–46, illus., 1968; originally published 1963.

The complete paper with this title was originally published in *Clays and Clay Minerals*, v. 10, 1963.—GDC

00495 **Weeks, Edwin P.** Determining the ratio of horizontal to vertical permeability by aquifer-test analysis: Water Resources Research, v. 5, no. 1, p. 196–214, illus., table, 1969.

The ratio of horizontal to vertical permeability may be determined by analysis of drawdown data from piezometers or partially penetrating observation wells near a partially penetrating production well. The analyses are made by comparing measured drawdowns in the piezometers to those predicted if the production well fully penetrated the aquifer. The differences between the measured and predicted drawdowns are determined, and the distances from the pumped well at which these differences would occur in an isotropic aquifer are determined from an equation. The permeability ratio is computed as the square of the ratio of actual distances to computed distances. The ratio of horizontal to vertical permeability in glacial outwash in central Wisconsin was determined from 5 aquifer tests to range from about 2 to about 20.—Author's abstract

00372 **Weinstein, David A.** Palynology of the San Sebastian coal (Oligocene) of Puerto Rico [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 33, 1969.

Weiss, Malcolm P. *See* Ali, Syed A. 06606

00391 **Weller, J. Marvin.** The course of evolution: New York, McGraw-Hill Book Co., 696 p., illus., tables, 1969.

This comprehensive textbook has been written from the paleontologist's viewpoint, treating mainly the plants and animals known to a reasonable extent, or entirely, as fossils. Some other organisms very important in the world today are not treated because they are unknown as fossils. The book is designed to occupy the middle ground between popular and technically specialized, by presenting the general trends in evolution in a manner understandable to persons with some elementary knowledge of biology. Related groups of phyla or other major taxa are treated, from bacteria through the highest vertebrates; the illustrations provide considerable morphologic information. Final chapters deal with problematic fossils and the pattern of

evolution through geologic time. Bibliographies follow each of the 14 chapters.—VMJ

06698 **Westgate, J. A.** Surficial geology of the Foremost–Cypress Hills area, Alberta: Research Council Alberta Bull. 22, 121 p., illus., tables, geol. map, 1968.

The Foremost–Cypress Hills area has six physiographic units: Cypress Hills Plateau, upland areas, till plain, lacustrine plains, river channels, and canyons. Glaciation modified the preglacial physiography of upland areas to a lesser extent than of lower tracts. End moraine is the most widespread glacial landform. The color, texture, pebble composition, heavy minerals, and carbonate content in till matrix of several till sheets were studied. Textures were largely controlled by bedrock, and younger tills contain less carbonate pebbles than older. Maximum altitude reached by Laurentide glaciers was 4,500 feet; earlier glaciers moved across the area in a southeasterly direction. Dominant direction of later lesser glaciers was south and southwest. Pleistocene stratigraphic units are named; drift sheets are morphostratigraphic units.—*from* Author's abstract

06729 **Westgate, J. A.** Linear sole markings in Pleistocene till: Geol. Mag., v. 105, no. 6, p. 501–505, illus., 1968.

Current-produced sole markings are not uncommon in the Pleistocene continental till deposits of Alberta, Canada. Groove, striation, and prod moulds have all been recognized, characteristically occurring in close association on the undersurface of the till beds. These sedimentary structures provide a rapid means by which local ice-flow directions may be determined.—Author's abstract

Wetherill, G. W. *See* Bickford, M. E. 00421

Wetherill, G. W. *See* Wai, C. M. 06674

White, W. R. H. *See* Savage, J. C. 06653

White, William B. *See* Deike, George H., 3d. 00475

Whitmore, Frank C. *See* Schultz, C. Bertrand. 00535

06682 **Whitten, E. H. Timothy.** FORTRAN IV CDC 6400 computer program to analyze subsurface fold geometry: Kansas Geol. Survey Computer Contr. 25, 46 p., illus., tables, 1968.

This program for the CDC 6400 computer is designed to permit description and analysis of subsurface folds on the basis of well-log data when dip and strike information are not available. Dip data, if available, can be used directly by the program. Description of folds may be viewed as an end in itself. If folds in adjacent areas are described in terms of scalars, however, areal variability may have distinct trends that permit limited extrapolation into neighboring unexplored areas. It is also possible, if the folds are described in a quantitative manner, to correlate fold attributes with other geologic variables in an attempt to determine factors of control in differing fold geometry. Logic used in the program is outlined; points for decisions on choice of constants and scaling factors are presented. Examples illustrate use of subsurface well and orientation data.—GDC

Whittig, L. D. *See* Wildman, W. E. 06756

06638 **Wiggins, Ralph A.** Monte Carlo inversion of body wave observations [abs.]: Earthquake Notes, v. 39, nos. 3–4, p. 18–19, 1968.

06756 **Wildman, W. E.; Jackson, M. L.; Whittig, L. D.** Serpentinite rock dissolution as a function of carbon dioxide pressure in aqueous solution: Am. Mineralogist, v. 53, nos. 7–8, p. 1252–1263, illus., tables, 1968.

Serpentinite rock in four California locations under soils high in iron-rich montmorillonite was ground to a powder and suspended in water in which the partial pressure of CO_2 was varied by bubbling N_2 or various air–CO_2 mixtures through

the suspension. Analyses for Mg and Si were made after four hours, and 1,8,15,22, and 29 days. In the high-CO_2 solutions (10-100 percent CO_2 gas) both Mg and Si dissolved more rapidly and reached higher concentrations than in the low CO_2 solutions (N_2, air and 1 percent CO_2 gas). But the Mg:Si ratio was also higher in the high CO_2 solutions, suggesting that soil water, enriched in CO_2, removes Mg from the system. Fe and Al, present as impurities in the serpentinite, presumably rearrange to form the octahedral layer of the soil montmorillonite.—Authors' abstract

06595 **Williams, E. G.; Bergenback, R. E.; Falla, W. S.; Udagawa, S.** Origin of some Pennsylvanian underclays in western Pennsylvania: Jour. Sed. Petrology, v. 38, no. 4, p. 1179-1193, illus., tables, 1968.

Pottsville and Allegheny underclays show significant between-bed variation. The high alumina clays of the Pottsville and lower Allegheny are the lateral facies equivalents of marine limestones or shales which contain relatively abundant illite, chlorite, Fe_2O_3, and silica. Paleogeographically, the high alumina clays are located in swampy areas on abandoned clastic wedges fringed by shallow seas. It is concluded that both stratigraphic and geographic variations in the clay mineral composition of underclays is largely controlled by the chemistry of the depositional environment.—*from* Authors' abstract

Williams, James H. *See* Vineyard, Jerry D. 06696

Williams, Richard S., Jr. *See* Friedman, Jules I. 06389

00373 **Williams, Thomas E.** Fusulinidae of the Americua Limestone Member (Lower Permian), Kansas and Oklahoma [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 34, 1969.

06385 **Williamson, A. N.** Gamma-ray measurements to evaluate soil properties, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 737-746, illus., 1968.

Gamma radiation data for United States and Puerto Rico soils were arranged according to land use, geological type and age, and soil groups. By plotting the gamma-ray photopeak count ratios of Th-232/K-40 versus U-238/K-40 and the normalized photopeak counts for U-238 and Th-232 versus sand content, it was shown that the criteria for separating the soils were either too broad or not significant to the gamma-ray emissive characteristics of soil. However, the data showed that the Th-232 and U-238 photopeak counts depended upon the particle size distribution in the soil and indicated that gamma-ray measurements can provide a qualitative indication of sand content.—GWL

06654 **Wilson, James T.** Glacial rebound and earthquakes [abs.]: Earthquake Notes, v. 39, nos. 3-4, p. 11-12, 1968.

00374 **Wilson, L. R.** Growth and development of palynology in North America [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 34-35, 1969.

00468 **Wilson, L. R.** Geomorphology and radiocarbon dates of Tesesquite Valley, Cimarron County, Oklahoma [abs.]: Oklahoma Geology Notes, v. 29, no. 1, p. 21, 1969.

00375 **Wing, R. S.; Dellwig, L. F.** Radar expression of Virginia Dale Precambrian ring-dike complex, Colorado-Wyoming [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 35, 1969.

06598 **Winland, H. D.** The role of high Mg calcite in the preservation of micrite envelopes and textural features of aragonite sediments: Jour. Sed. Petrology, v. 38, no. 4, p. 1320-1325, illus., 1968.

Algal borings are responsible for the development of micrite envelopes, and high Mg calcite may be present in these borings and other void spaces within aragonite

grains. In these cases, the presence of the two minerals furnishes the solubility contrast necessary for the preservation of textural features in the face of massive solution. The earliest and most rapid change in the diagenesis of such a carbonate sediment is the stabilization of high Mg calcite as low Mg calcite. Simultaneously or later, aragonite may undergo solution, leaving behind a fine network of the less soluble low Mg calcite which is pseudomorphic after high Mg calcite. This network is essentially a skeleton of the original texture of the sediment and serves as a mold and nucleation site for later infilling by calcite.—*from* Author's abstract

06509 **Wittlake, Eugene B.** Fossil mosses from the upper Wilcox (lower Eocene) of Arkansas: Am. Midland Naturalist, v. 80, no. 2, p. 543–547, illus., 1968.

Two previously unreported sites in the upper Wilcox Formation (lower Eocene) on Crowley's Ridge, Arkansas, are being studied. Two new fossil mosses, *Hypnites arkansana* Wittlake, n.sp., and *Muscites wilcoxensis* Wittlake, n.sp., are described. Problems concerning the systematic treatment of fossil Bryophyta are discussed briefly.—KAF

06532 **Witty, John Edward.** Classification and distribution of soils on Whiteface Mountain, Essex County, New York [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 1903B–1904B, 1968.

06456 **Wood, D. L.; Nassau, K.** The characterization of beryl and emerald by visible and infrared absorption spectroscopy: Am. Mineralogist, v. 53, nos. 5–6, p. 777–800, illus., tables, 1968.

Absorption measurements with polarized radiation in the visible, ultraviolet and infrared regions were used to study and interpret the centers responsible for the differences among the various types of beryl, including emerald.—JLH

Wood, D. L. *See* Nassau, K. 06459

Woodward, Herbert P. *See* Cardwell, Dudley H. 06712

00443 **Woodward, Lee A.** Petroleum exploration in western United States in light of principles of comparative tectonics [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 212–213, 1969.

00450 **Woodward, Thomas C.** Project Thunderbird—An *in situ* coal-extraction research program [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 214–215, 1969.

06560 **Workman, William Edward.** Wollastonite in regionally metamorphosed rocks, Blount Mountain, Llano County, Texas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2092B, 1968.

06785 **Wright, Alan C.; Rupert, J. Paul; Granquist, W. T.** High- and low-silica faujasites—A substitutional series: Am. Mineralogist, v. 53, nos. 7–8, p. 1293–1303, illus., table, 1968.

For synthetic faujasites with SiO_2/Al_2O_3 mole ratios from 2.44 to 4.93, the unit-cell parameter, a, and the positions of certain infrared bands varied linearly with mole fraction of AlO_2^-. Natural faujasite from limburgite from the Kaiserstuhl in southwestern Germany was near the high-silica end member of the series, although the lattice constant and one of the infrared bands deviated slightly from the linear relationship of the synthetics. This deviation can be explained by the likely presence of a small amount of amorphous silica in the synthetic samples. A uniform nomenclature is proposed, for example faujasite, sodium (2.44), which identifies the structure, exchange cation and position in the SiO_2/Al_2O_3 stability range.—Authors' abstract

Wright, H. E., Jr. *See* Florin, Maj-Britt. 00558

Wright, T. L. *See* Decker, R. W. 06524

00457 **Wulf, George R.** Cretaceous Muddy Sandstone in northern Rockies [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 1, p. 217, 1969.

Yamaguchi, Goro. *See* Kubo, Yasushi. 06584

Yehle, Lynn A. *See* Nichols, Donald R. 00428

Yen, Yin-Chao. *See* Fan, S. S. T. 06686

06561 **Young, Leonard Maurice.** Sedimentary petrology of the Marathon Formation (Lower Ordovician), Trans-Pecos, Texas [abs.]: Dissert. Abs., Sec. B, Sci. and Eng., v. 29, no. 6, p. 2092B-2093B, 1968.

06375 **Young, R. A.; Sudarsanan, K.; Mackie, P. E.** Structural origin of some physical property differences among three apatites, *in* Colloque international sur les phosphates minéraux solides, Toulouse, 1967—V. 1, Structure et propriétés des phosphates: Paris, Soc. Chim. France, p. 114-117, illus., tables, 1968.

Detailed structural information now available for fluorapatite, hydroxyapatite, and chlorapatite provides new opportunities for inquiry into the crystal structural origin of various properties. The three differ for the most part only in the choice of X-ions (F, OH, or Cl) and their locations along the screw axis. In all three the PO_4 tetrahedra are distorted.—ESL

00376 **Zachry, Doy Lawrence, Jr.** Sedimentologic regimes and facies development in the Marble Falls Formation of Texas [abs.]: Geol. Soc. America Abs. with Programs 1969, pt. 2, South-Central Sec., p. 35-36, 1969.

06405 **Zaitzeff, James B.; Sherman, John W., 3d.** Oceanographic applications of remote sensing, *in* Symposium on remote sensing of environment, 5th, 1968, Proc.: Ann Arbor, Mich., Univ. Michigan, Willow Run Labs., p. 497-527, illus., 1968.

Ocean phenomena being investigated by remote sensors include sea surface temperature, wave conditions, water/ice/land interfaces, biological indices, and water color analyses. The sensors being used include sonar, airborne photography, infrared thermometers and imaging scanners, radar, passive microwave, and television, photography, and infrared radiometry from Earth orbiting satellites.—GWL

00509 **Zierfuss, H.** Heat conductivity of some carbonate rocks and clayey sandstones: Am. Assoc. Petroleum Geologists Bull., v. 53, no. 2, p. 251-260, illus., tables, 1969.

Heat conductivity studies may be useful in determining rock types and shaliness in sandstones, and conductivity may be related to porosity, degree of cementation, geometry of constituents, and pore size. In this report conductivity studies were made on more than 1,000 rock samples that included limestone, dolomite, and anhydrite of Oligocene-Miocene age and clayey sandstone of Tertiary age. Results showed that the heat conductivity values of carbonate rocks depend on rock fabric and porosity, and that the presence of anhydrite increases the conductivity. The heat conductivity of carbonates is described fairly well by the empirical formula of Sugawara and Yoshizawa (1962). Heat conductivity of clayey sandstones is best expressed in terms of porosity plus clay content as a percentage of bulk density.—SEF

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